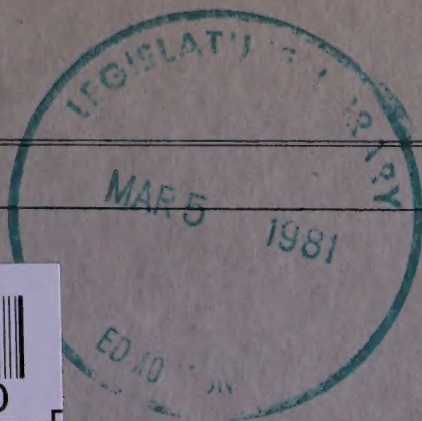


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The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions
relating to the proposed Export of Natural Gas from the Province of Alberta.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: September 20th, 1951.

Volume 8.

I N D E X

VOLUME 8.

20 September 1951.

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THE CHAIRMAN: Any further questioning of Mr. Dougherty?

MR. McDONALD: I haven't any questions. I understand Mr. Trostel will deal with the matter of deliverability.

MR. PORTER: That is right.

THE CHAIRMAN: Mr. Smith?

MR. S.B. SMITH: No. I concluded my cross-examination, sir.

THE CHAIRMAN: Mr. Nolan?

MR. NOLAN: Nothing, sir.

MR. BREDIN: I would like to ask Mr. Dougherty a few questions.

JACK F. DOUGHERTY (recalled)

already sworn, cross-examined by Mr. Bredin:

Q Mr. Dougherty, you were not concerned in this survey with the cost of purchasing gas or distributing gas, were you?

A No, sir.

Q And would it not be true that some of the gas which you have outlined in your reserves at the present price would not be marketable?

A I think that is a fair assumption.

Q And that gas might become marketable at a higher rate than is now being paid by present consumers?

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A That has been the history of the gas industry.

Q But in answering Mr. Steer you told us you understood it was the function of the Board that they were to ensure an available supply to Alberta without an increase in price before export is permitted, so that some of the reserves you have outlined would not be marketable at the present cost of gas to consumers at the present time?

A That would be true. However, we are also considering a 30-year supply, a change in the economic picture over 30 years. We do not anticipate the instantaneous connection of all those fields, therefore the situation is a little hypothetical.

Q And I do not suppose you can say how much of the 8 trillion feet is not presently marketable?

A Well, there is such a limited market. The question of what is marketable is a function of whether you have a market for it.

Q Supposing there was a market at the present price, how much of that 8 trillion feet would be available for the market or could be commercially marketable?

A I could not tell you.

Q That is all.

MR. PORTER: Would you prefer me to go ahead of Mr. Smith? I thought perhaps he might want to be last. He may have some questions arising out of what I have.

MR. C.E. SMITH: I might as well go ahead.

Mr. Porter in re-examination may have something to say out of what I have to say. I am not fighting for

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position.

MR. PORTER: Neither am I. I thought the Board might want you to follow.

MR. C.E. SMITH: I think probably as done previously, I usually go last and counsel re-examines. Is that satisfactory?

MR. PORTER: That suits me fine.

EXAMINATION BY MR. C.E. SMITH:

Q Mr. Dougherty, you remember at Edmonton I told you whatever else anyone may be doing with you, I am looking for information?

A Yes, sir.

Q Do you follow me?

A I quite understand.

Q Even though I may have mentioned it at Edmonton, I would like to refer to it again to just keep it in your mind, namely, the provisions of our Act. You have undoubtedly read it?

A I have read it once, yes.

Q And you remember amongst other things Section 3, namely:

"3. The intent, purpose and object of this Act is to effect the preservation and conservation of the oil and gas resources of the Province and to provide for their effective utilization, having regard to the present and future needs of the residents of the Province."

And sub-section (2) of Section 7:

"(2) The Board shall not grant a permit for the

Mr. J. Edgar Hoover
Washington, D. C.

Dear Sir:

Enclosed

is a copy of the report of the

Commission on the

Administration of the

Department of Justice

for the year 1954.

I am, Sir, very

Very truly yours,

Mr. Hoover, you will find

that the Commission has

concluded

that

the

Commission

has found that the

Department of Justice

has been

very

effective

in its

administration

of the

Department

and

the

Commission

has

found that the

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"removal of any gas from the Province unless such gas, in the opinion of the Board, is surplus to the present and future needs of the people of the Province."

You will remember, Mr. Dougherty, that in subsequent sections there is a wide discretion in the Board in the event of an emergency in the Province whereby even after an export permit is granted they may in an emergency, for instance, stop gas to Ontario if they feel the people of this Province need it?

A That is my understanding, yes.

Q In other words, they may even go so far as to say, "I'll keep Smith warm and let Crozier freeze to death in the middle of winter"?

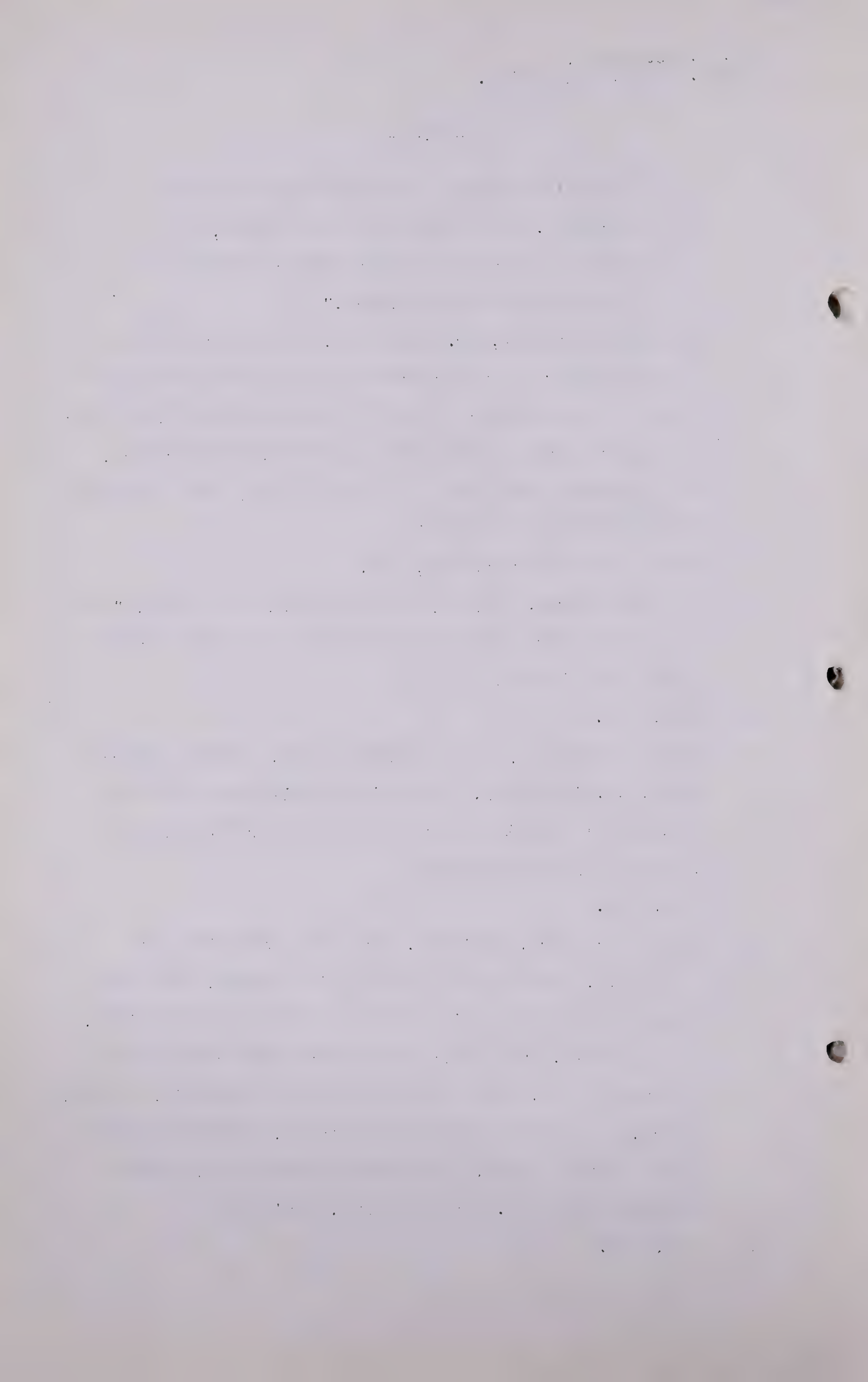
A Yes, sir.

Q That is purely by way of illustration. Having regard to that, Mr. Dougherty, I take it you will agree with me that under this Act there is a pretty tremendous responsibility on this Board?

A Yes, sir.

Q That is correct, isn't it. And if I appreciate it correctly, they may have sort of two duties, one with regard to the protection of the people of the Province, and secondly, and I wish some of the applicants would emphasize this, that is the effective utilization of gas, which, I think you will agree with me, may and probably does include export, if I dare use that word, representing the Board. That is true, isn't it?

A Yes, sir.



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Q I mean, the Board are not just here, as I see it, to protect the Province but also to see to the effective utilization, which may constitute export.

A Yes, sir.

Q You certainly will agree with me in that. Having regard to their duties, you also agree with me, I take it, that this Board dare not, and I am not being facetious, dare not stick its neck out at all, either with regard to protection or the question of export?

A I understand that, yes, sir.

Q In other words, you will agree with me that they have to use all care humanly possible in deciding their duties under this Act?

A Yes, sir.

Q Now, I do not want to re-hash a lot of things that have gone before, but if my observation is correct, the estimates from various able and experienced experts vary all the way from Leisemer's 3 million 635, to yours at 10 trillion 394, as of approximately the same dates?

A That is right.

Q That is pretty near correct, isn't it?

A Yes, sir.

Q And I think you dealt pretty well with the question of judgment of experts, if I may use that term, when Mr. Steer was examining you. I think he mentioned Mr. Davis's name with yours, and I think that part of it was due to difference in judgment but is there anything else that you can assist us in by explaining why Leisemer should be that low and you should be that high?

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I am only using those two names because you happened to be talking about them.

A I think there are several things. One in particular is that as you will note in our Exhibit 10, the third sheet under general data, the number of fields and prospects which we attempted to make some estimate of gas reserves. As explained in Edmonton, our system was to exhaustively study each occurrence of gas in the Province, whether it was a measurable volume or gas in a test or whether it was an indicated show of gas, because many of those shows or small volumes may be on the edge of reservoirs or may be in the general vicinity of accumulation which will develop in the future. Therefore, we consider that our work has been perhaps most comprehensive in its scope. The differences between our estimates and other estimates is a function of the time and man hours in addition. We did not have all of the information on these fields and prospects but I think you will agree that we have accumulated a fair mass of information.

Q I think I will agree with everything you said.

A I think that is the primary difference, the scope and intensity.

Q When you say "scope and intensity", does that apply to the work you have done or to the scope, possibly, of areas you have dealt with?

A Both.

Q That would be true of Leisemer, undoubtedly?

A Both. That is, we have estimated more fields, spent more time individually on the fields, perhaps, for this proceeding.



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Q Now, is there anything else you have in mind that may assist us, Mr. Dougherty, in a general way?

A I do not think so. No, sir, I think that is in essence it.

Q Have you J-41? That is what I might call the Leisemer exhibit at the last Joint Hearing.

A I have had, I do not have at this moment.

Q Have you it with you, Mr. Porter?

MR. PORTER: No, I have not.

Q MR. C.E. SMITH: What I wanted to refer to, Mr. Dougherty, was Mr. Leisemer on the Viking-Kinsella field and just ask you - Appendage 4, the pages are not numbered.

A Yes, sir.

Q And you will observe there that he used the material balance method with respect to the results which he gets on that particular page?

A That is true.

Q Probably you would like first to discuss as briefly as you can, being consistent, the use of the material balance by Leisemer with respect to this field. Is there anything wrong with the method he has adopted there?

A The first observation I have to make is that I have no way of knowing the area over which the weighting of the pressures occur or if they were weighted. You see, essentially the material balance calculation depends upon dealing with the entire reservoir volume.

Q That was not included in the notes made available to you by him?

A No, sir.

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Q Yes?

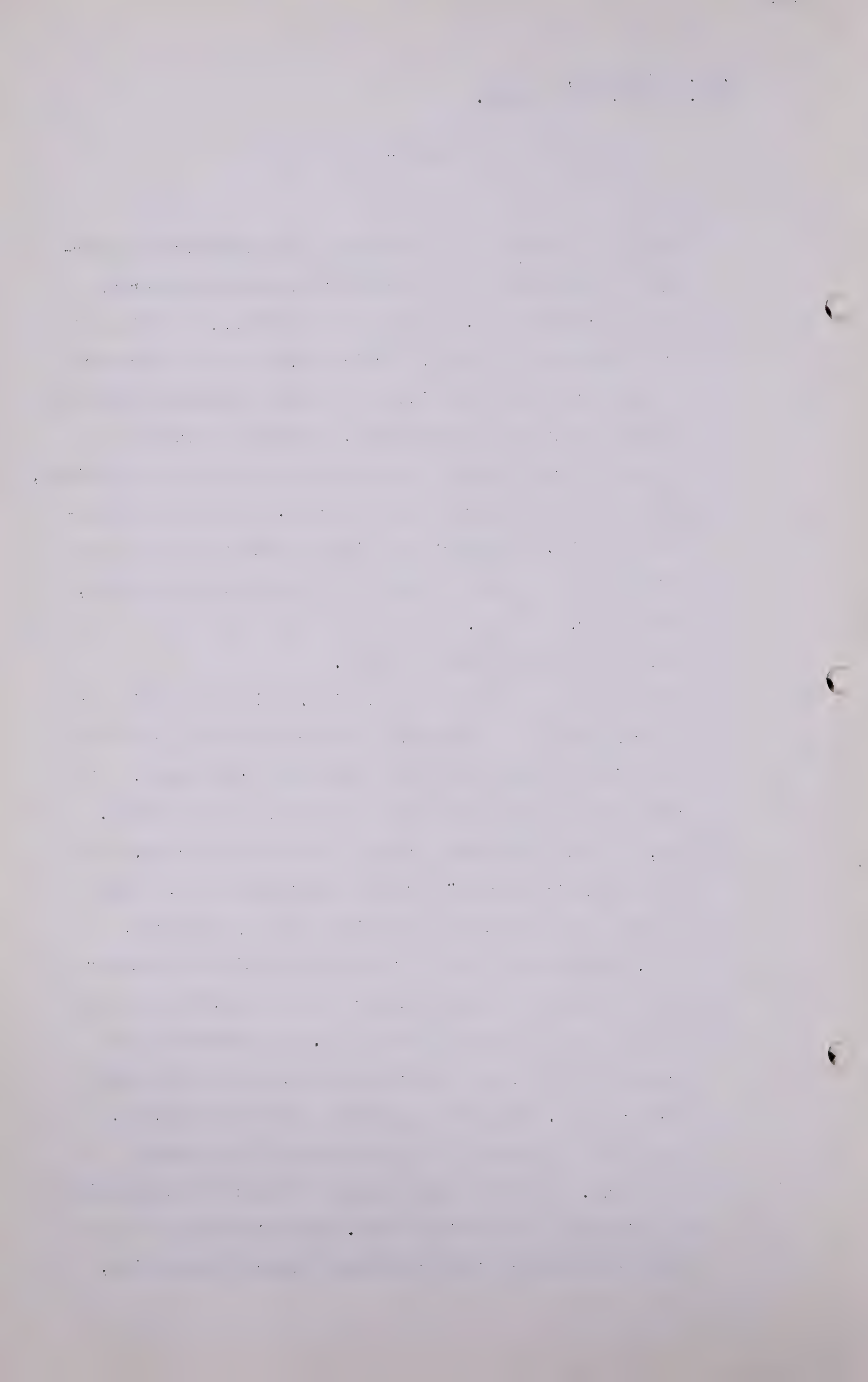
A Because the factor of weighting of the pressures is perhaps the most important factor in the entire material balance calculation. In most calculations, a series of trial balances are made, particularly in oil reservoirs as well as in gas, to find out the most probably reservoir volume by mathematical methods. Without taking the entire reservoir into your weighting in so far as possible, the weighted pressures are incorrect. I get the impression from Mr. Leisemer's submission that the area of the weighting is restricted closely to the developed wells, much as Mr. Davis's.

Q Yes, that may probably be right.

A That would be my first observation. Without knowing the lateral extent of the assumed reservoir then I can not criticize further what this estimate represents. It represents a portion of the reservoir, is my feeling.

Q Yes, so that does that prevent you from criticism, and when I say "criticism" I mean commenting on it, of any of the other detail that is given here by Leisemer?

A Well, I think that all of the other detail is a matter of calculation or was a matter of the original pressures which we are in fair agreement on, the volume of gas produced between the intervals chosen for the pressure measurements. We are in agreement on those figures. The basic difference is in that matter of pressure weighting. I do not know whether it would be appropriate at this time but in view of Dr. Govier's request to go into this matter of the material balance calculation,



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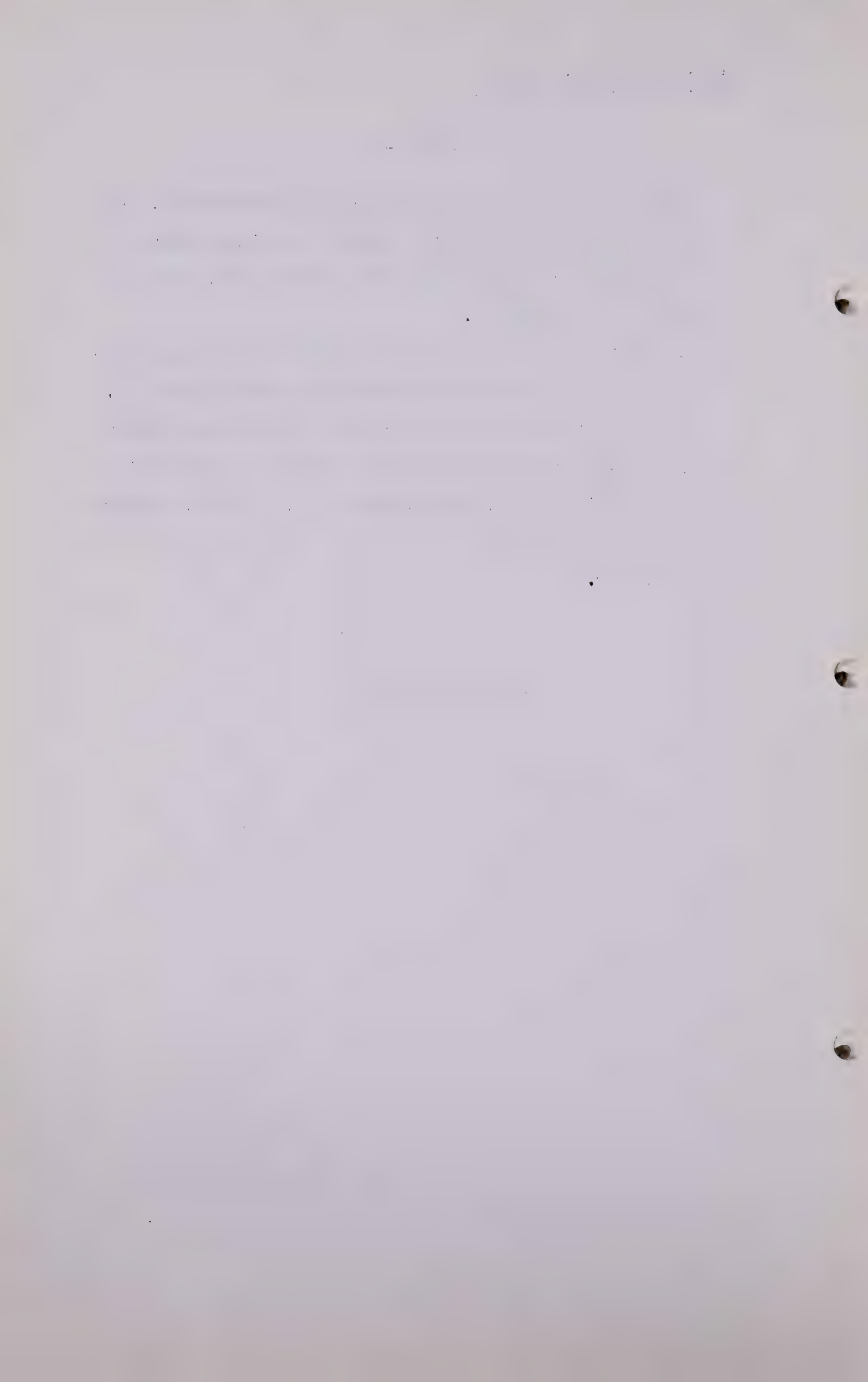
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the pressure decline picture in Viking-Kinsella, we have spent a considerable amount of time working with that and I could go into that at this time, if that would be convenient.

Q I think I would prefer if you would leave it and discuss it with somebody that knows something about it. I wanted to know whether or not there was any comment you could presently make with respect to Leisemer's calculations here, and you have done, I think, primarily what I had in mind.

A Yes, sir.

(Go to page 600)



J. F. Dougherty,
Cr. Ex. by Mr. C. E. Smith.

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Q Now, while we are at Liesemer, do you mind just retaining that volume G-14 there?

A Page 14?

Q No, retaining G-14?

A Yes.

Q And you will observe on page 1, paragraph 2, this statement, Mr. Dougherty,-

" The division of reserves into proved, probable and possible has been discarded in favour of the American Gas association Committee definition that every discovery 'proves' a gas reserve,"

and that is along the lines you have already indicated, I think, Mr. Dougherty?

A Yes, sir.

Q "...with the proviso that 'care should be exercised to limit the area to that proved beyond a reasonable doubt'."

Now, we have discussed that, I think?

A Yes, sir.

Q With you previously?

A Yes.

Q Now, going on to paragraph 3,

" It has been arbitrarily assumed that, in general, any reserve of less than 20 billion of marketable gas cannot be economically gathered," and there is the reference there to Appendix II B?

A Yes, sir.

Q Will you look at Appendix II B, Mr. Dougherty?

A Yes, sir.

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Q I wish these pages were numbered?

A Where is the Appendix?

Q He has several of them, they start at page 15, Appendix I of two pages, and then Appendix II.

A Well, this appears to be a limited copy, there is nothing after page 15. I think I know what you are referring to, however.

Q Probably you do, I have no doubt that you do. There is a reference to DeGolyer in that Appendix II B, and it is very apparently a quotation taken from Docket N.G.-580-FPC, and it is taken out of context, of course?

A Yes, sir.

Q But the quotation is as follows:-

" TThe number and minimum size of fields to be included are also important considerations. Since each field must be studied individually it is generally not practical to include many of the small fields, which even in the aggregate would not increase materially the amount of the total estimates reserves. In his comprehensive reserve estimate, De Golyer -",

is it "DeGolyea" or "DeGolyer"?

A DeGolyer.

Q ".....limited the size of the fields considered to those believed to have 20 billion cubic feet or more, which include some 486 fields."

And then it gives Docket number so and so. I take it that insofar as Mr. DeGolyer is concerned, with respect to that particularly, in any event, you do not want to

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disagree if DeGolyer said that?

A I would disagree or explain, if I may.

Q Pardon?

A I would disagree or explain, if I may.

Q Well, I was going to ask you that later, but I thought I would be fair to you in view of the name that is used here. However, what I was going to ask you - well, first, if you disagree, you disagree with respect to the Province of Alberta, I take it, is that what you have in mind?

A You see, it is a matter of the volume of work and time. If there were 486 fields estimated over 20 billion, the multitudes below 20 billion, 1 well, 2 wells and 3 wells in the United States, the estimation, I expect, would be over a period of several years. As a matter of fact, the staff finished in December of 1950, a survey of every single gas field in the United States, and it took a good many tens of thousands of man-hours and almost two years, so that the estimate which is referred to under that docket was an estimate made in a limited time for the broad picture which the Federal Power Commission was building up under that Docket over the general gas industry. It was no reflection upon the smaller fields, except there was not the time or information to do the work.

Q Well, I take it then that it was really a matter of the work that this remark was made?

A Yes, sir, I have discussed that quotation with Mr. Morrell, the executive manager of DeGolyer & McNaughton, who supervised that work. He was in Calgary last week. And his

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observations are those which I have just repeated, that the basic reason for the limitation was the time and the difficulty of getting individual well data from the multitude of operating companies in the States, and since there is no central body which accumulates that information within most of the States, as there is here in Alberta, that is one of the reasons.

Q Well, I am glad to hear that explanation because Mr. Liesemer apparently misinterpreted it or, at least, interpreted it without that explanation available to him that you have given here, and he took it as a statement on page 1 of his submission.

Q I am quite sure that nothing on the basis of economics or marketability appeared in that distinction, of that I am quite certain.

Q Well, then, we should take it that that quotation does not mean what Liesemer thought it meant, is that a fair way of putting it?

A I think that is quite true.

Q And you can see if we had this quotation, we would have thought that Liesemer's conclusion was fair without your explanation?

A Yes, sir.

Q So that statement of Liesemer's now, in your opinion, should not have application to the Province of Alberta, or any place else similar, is that fair?

A It is certainly true when a problem of this scope is the issue.

Q Now, just a few references to some of the nice discussions we had in Edmonton, Mr.Dougherty, and first I would like

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to refer to page 18. Have you the transcript there?

MR. PORTER: I have it.

Q MR. C. E. SMITH: That is, of course, Volume 1,
page 18.

A Yes, sir.

Q In the matter of the Delhi application, of course?

A Yes, sir.

Q And will you look at the bottom of the page? I do not
want to read all of that long paragraph, You see the
words there "We have just completed a sub-contract
from Ford, Bacon & Davis"?

A Yes, sir.

Q The last sentence on that page?

A Yes, sir.

Q And may I read it and you follow your copy?

A Yes, sir.

Q "We have just completed a sub-contract from Ford,
Bacon & Davis, prime contractors of the Corps
of Engineers, consisting of a complete study of
every gas field and oil field in the United
States, designed to estimate the future avail-
ability of natural gas for the manufacture of
synthetic fuels in the event of an emergency.
This study has taken about two years, employed
the greater part of our staff most of the time.
It is coming out in volumes by States, and has
just been completed and will be released through the
publications of the Bureau of Mines of the United
States Government."

The only question I have with respect to that, Mr.Dougherty,

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is this: In that study that your firm made was a similar method adopted to the method you had adopted here and shown in Exhibits 4, 4A and 10?

A Similar, but not published in this detail with the accompanying and substantiating maps, because the volume would have been just too great. However, the estimates were for proved developed, proved undeveloped, probable and possible, that is my recollection.

Q Proved developed?

A Yes, sir.

Q Proved undeveloped, probable and possible?

A Something on that order. It is a little vague as to the sequence, because the contract provided that since the scope of the study anticipated a long-time future problem the Corps of Engineers also wished to know what lay immediately outside of the realm of proved which would occur as the result of drilling a future development.

Q But in any event, what I might call the system adopted in your work, whether or not it was put out in detail eventually or not, was, I don't know of a better word, similar, in any event, to the one used here?

A That is correct.

Q Was there any great difference aside from what you have just mentioned?

A I do not believe so.

Q I mean, in the method that you adopted?

A No, sir.

Q You took it field by field and did it in the same way you did here?

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A Yes, sir. Our information was more limited though.

Q And is that out yet, by the way?

A I do not know whether it is released or not. I think the final revisions are still in process.

Q What I mean by "out" is, would it be available to anybody who can afford to get it?

A I think so. That is my understanding.

Q Now, will you look at page 34, Mr. Dougherty?

A Yes, sir.

Q At the very top of the page?

A Yes, sir.

Q "Following the introductory submission, we have summarized your Census Divisions. The Provincial reserve, that's behind the tab sheet entitled 'Provincial Reserves'. You will note that with the exception of Census Divisions 9, 15 and 17 we have estimated some fields within each Census Division. 17 is the northeasternmost Census Division in the general Wabiskaw Lake area, which we didn't estimate reserves even though there is considerable gas saturation, because of their inaccessibility and the general high cost of development."

I refer particularly to your last words, "and the general high cost of development" as being one of the reasons why you did not estimate Wabiskaw Lake, the Wabiskaw Lake area in this case?

A That is correct.

Q Do you agree with me, Mr.Dougherty, that the general high cost of development is something that this Board must

J. F. Dougherty,
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consider probably even to a greater extent than you do?

A Yes, sir, I agree with you exactly.

Q I thought you would, but I wanted to make sure I got it on the record?

A Yes, sir.

Q And I refer now to page 104, at the bottom of page 104?

A Yes, sir.

Q And here, incidentally, you are speaking of the Viking-Kinsella area, you observe that from up above?

A Yes, sir.

Q And at the bottom of the page we have this,-

"We realize that the sand will be thin toward the edges, but the permeabilities in the Viking sand are surprisingly high. From some core analyses we have seen..."

and I think there may be something missing there?

A I think something is missing there, yes, sir.

Q "That the migration of gas from these outer areas may be an appreciable factor in the not too distant future".

And I refer again to that, "That the migration of gas from these outer areas may be an appreciable factor in the not too distant future." Having regard to the use of the words "may be an appreciable factor", without assuming the duties of the Board, can you tell me how they should interpret it, having regard to their responsibility? It is more than in the category of "may be" now, isn't it?

A Yes, sir, particularly in view of the exhibit Mr. Davis introduced in this proceeding.

Q Which one was that, so that we will know, Mr. Dougherty?

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A The number escapes me at the moment.

MR.PORTER: I do not think it was marked.

MR. STEER: You mean that single sheet showing the pressure drop, the pressure build-up?

A Yes, sir.

Q That is Exhibit 12.

MR.PORTER: Oh, yes, the arithmetical averages.

A The more we have looked at that particular exhibit the better we like it.

MR. C. E. SMITH: That is 12, is it?

A Yes, sir.

Q So since you said "maybe", you think that Exhibit 12 substantiates your idea now, and that we should not have "maybe" in there at all?

A Yes, sir. The relationship between the decline and the pressure of the Kinsella No. 10 well and the build-up in pressure in the Viking area, is shown on this exhibit. And particularly you will note under the average casing pressure or closed pressure Viking wells in 1945 of 494 pounds build-up, or building up even with a substantial production to 501 pounds in 1950, with the decline in the pressure of Kinsella No. 10, and that certainly is a function of the lateral regional migration along the pressure gradients, and set up in the reservoir by reason of the pressure sink around the closely spaced Viking wells.

Q Well, that is an illustration of "maybe" early in this year now becoming "does" in September of this year, because of other information you have got, is that a

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fair way of putting it?

A That is a close interpretation of it.

Q Yes?

A I do not know that I would go that strong, but I would say "perhaps", yes, sir.

Q Now, having regard to the remarks I have just read to you, where you did not have the kind assistance of Mr. Davis that you have here, that "maybe" still may be true generally with regard to the thin sands with regard to the question of migration?

A I think following that little discussion on page 104 the remarks on the Panhandle Field on the succeeding page...

Q Yes?

Aare of importance, because it seems to occur in many reservoirs.

Q Well, you use the Panhandle as an illustration there, Mr. Dougherty?

A That is correct.

Q And you finish in this manner,-

"We are not too sure what this phenomenon is from. It may be a combination of migration from outside areas as well as loss of some wells with increased effective drainage factors for the remaining wells. At any rate, we feel it is impossible to ignore the thin areas in large areas such as the Viking."

A That is true.

Q And while you say "it is impossible to ignore", I wonder if you could help with regard to the position of the Board

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having regard to their position. They have got to go a little farther than to say to themselves "It is impossible to ignore it", so that can you help us a little bit by telling us in what way they should consider it and give effect to it, or give effect to it, if that is a better term, do you understand me, Mr. Dougherty?

A Yes, sir. And that comes back to the calculation of reserves either by the volumetric or material balance method involved, and any answer calculated from those methods which does not attempt to define the reservoir as closely as possible, its widest lateral extent, is going to be in error and be low in the reserve estimate, because that reservoir is going to perform, according to Boyle's Law, once a pressure differential is spaced across the thin areas, gas will migrate laterally into the pressure zones and through the roof of the field and be a very considerable factor in the production of gas and the upholding of pressures.

Q Now, then, apropos of that, let us carry on down to the bottom of page 105. I was going to ask you something about that later, but we might as well do that now. There is a reference there to the Texas Company's Ranfurly well, I think it is No. 1?

A That is correct.

Q And you go on to say,-

"..which is a more or less isolated well in
Township"

so and so, -

"which on drillstem test of the interval 2063
to 2111 feet yielded 6980 Mcf per day.

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" We checked some adjacent so-called dry
holes..."

and I emphasize that you do use the words "so-called
dry holes".

A Yes, sir.

Q "...and found that there were appreciable show-
ings of gas, not much, but indicating very likely
a density of gas saturation.

The intervening formation might not necessarily
yield 100% commercial wells, but the saturation
might be produced from such commercial wells as
could be drilled."

Now, with respect to migration, having regard to Ranfurly
No. 1, and with respect to your so-called dry holes, can
you give me some help, by way of helping a layman in any
event, just how or to what extent the migration will occur
generally down south from the area of the Ranfurly No. 1,
down to the other area, and you remember what I am talking
about?

A Yes.

Q Having regard to the so-called dry holes intervening, so
to speak?

A Yes.

Q It may be distance or it may be size, or something?

A In the Ranfurly area, referring to the maps in Exhibit 10,
Census Division 10, referring particularly to pages 5 and
6, and looking at them together, 5 representing the pres-
sure configuration in 1945 and 6 the pressure configuration
in 1950.

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Close inspection would indicate that on the basis of the pressure that the area of drainage above production comes from the wells in the Viking-Kinsella and is spreading out laterally into those areas which have no present wells developed. But the control exhibited by Kinsella No. 10 particularly illustrates the change in the area under depletion. In addition you might look at the Ranfurly area where you have the production coming from the Ranfurly well and if connected, you develop a pressure sink in the vicinity of that well which after long-time production from the addition of several more wells would then coalesce and join the pressure sinks developing within this Viking area.

Q Now that is something that you and I do not seem to agree on. I would have thought the migration would go the other way?

A It runs in the direction of the lowest pressure.

Q MR. GOODALL: Have you any records on the Ranfurly well?

A Yes.

Q Do you know if its pressure has dropped?

A No, I do not know. The only pressure information we have is the original pressure which was something in excess of 810 pounds.

Q That would be the original pressure?

A Yes, sir, that would be the original pressure.

Q But there has been a sink develop up there?

A Yes.

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Q Which would indicate the migration has not got that far north?

A That is true, but you would not expect it to reach that well for a long time. It would be of great assistance to our studies if we had more observation wells as in effect No. 10 is. Some of the old wells developed and then we would be able to get the pressures and the information on this sort of reservoir.

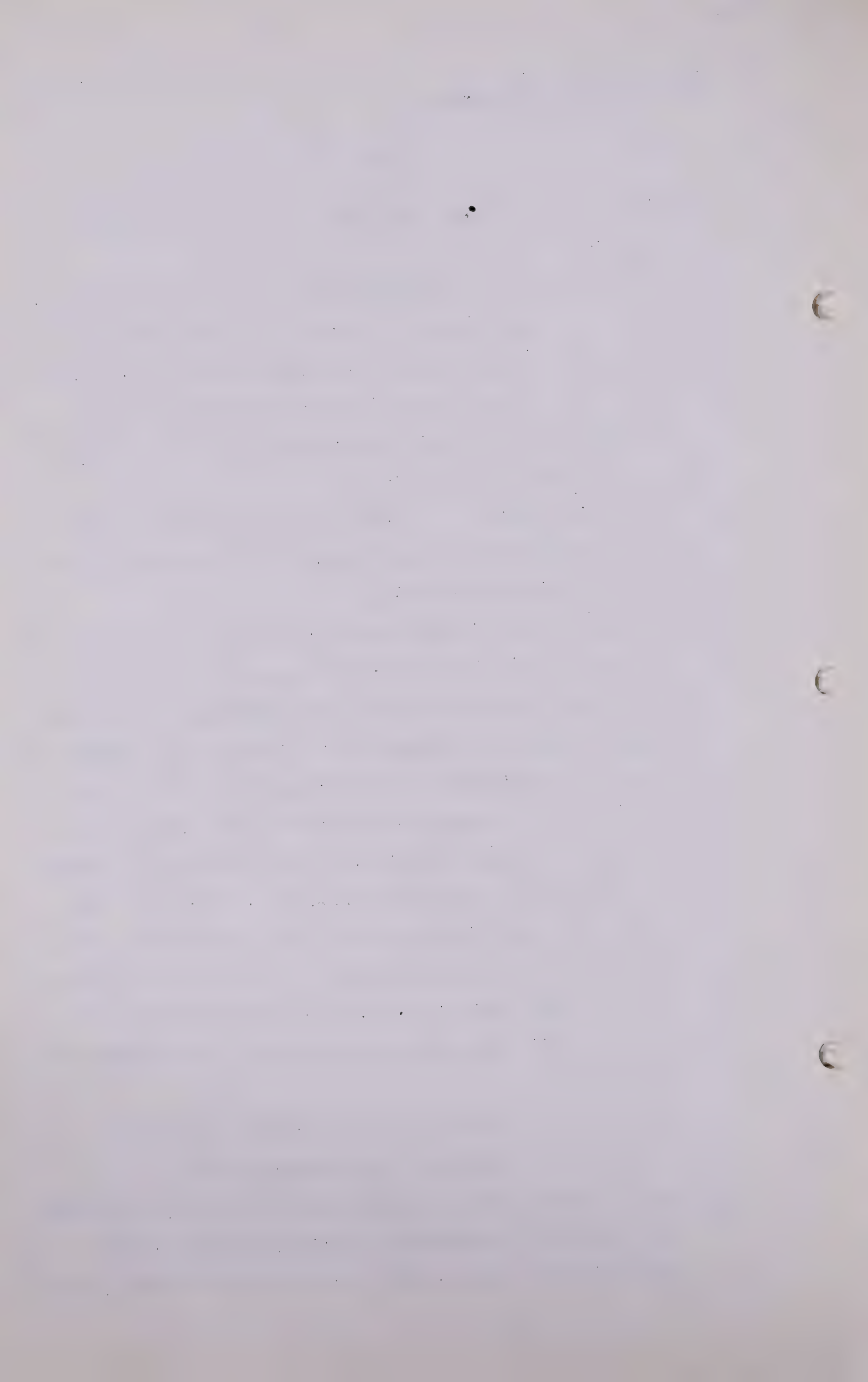
Q MR. C. E. SMITH: What is your control whereby the pressure contours on that Map 6 are extended considerably up towards the north?

A The detail again occurs between the wells on the east and to the northwest and No. 10. to the south. In other words where we lack control in intervening areas we know that the general configuration is going to be approximately that you get between the control points. No. 10 well has declined in pressure over that period since it was drilled, as shown in Exhibit 6, from something in excess of 610 pounds to 585 pounds in 1950. That gives some index, the only index we have. As I say if there were other observation wells drilled in that area the control would be much more accurate. This pressure picture we know is not correct but we hope that it approximates the picture.

Q And you hope eventually it will be found correct?

A I doubt that very much, but something close.

Q What I had in mind is having regard to the two so-called dry holes and having regard to the migration of this Ranfurly No. 1 down south, it struck me the result of the



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so-called dry holes would indicate low permeability, at least in the area, and I wondered whether or not that constitutes in some way a barrier or a partial barrier with respect to migration from Ranfurly 1, which is the start?

A I think in some places in this type of reservoir you always come across fairly low permeability areas.

Q And the result might be true here that your so-called dry holes would indicate that?

A You still have a flow in some volume and where you have a well say of 10 foot section with 5 or 6 million feet and then you have a 6 million foot well from a 2 foot section that indicates the proper relationship and they are not too far apart.

Q But the dry holes, do not they indicate some sort of a barrier to the migration?

A No, sir, we do not consider that. Now I do not know which dry holes you are referring to.

Q The ones you are referring to there.

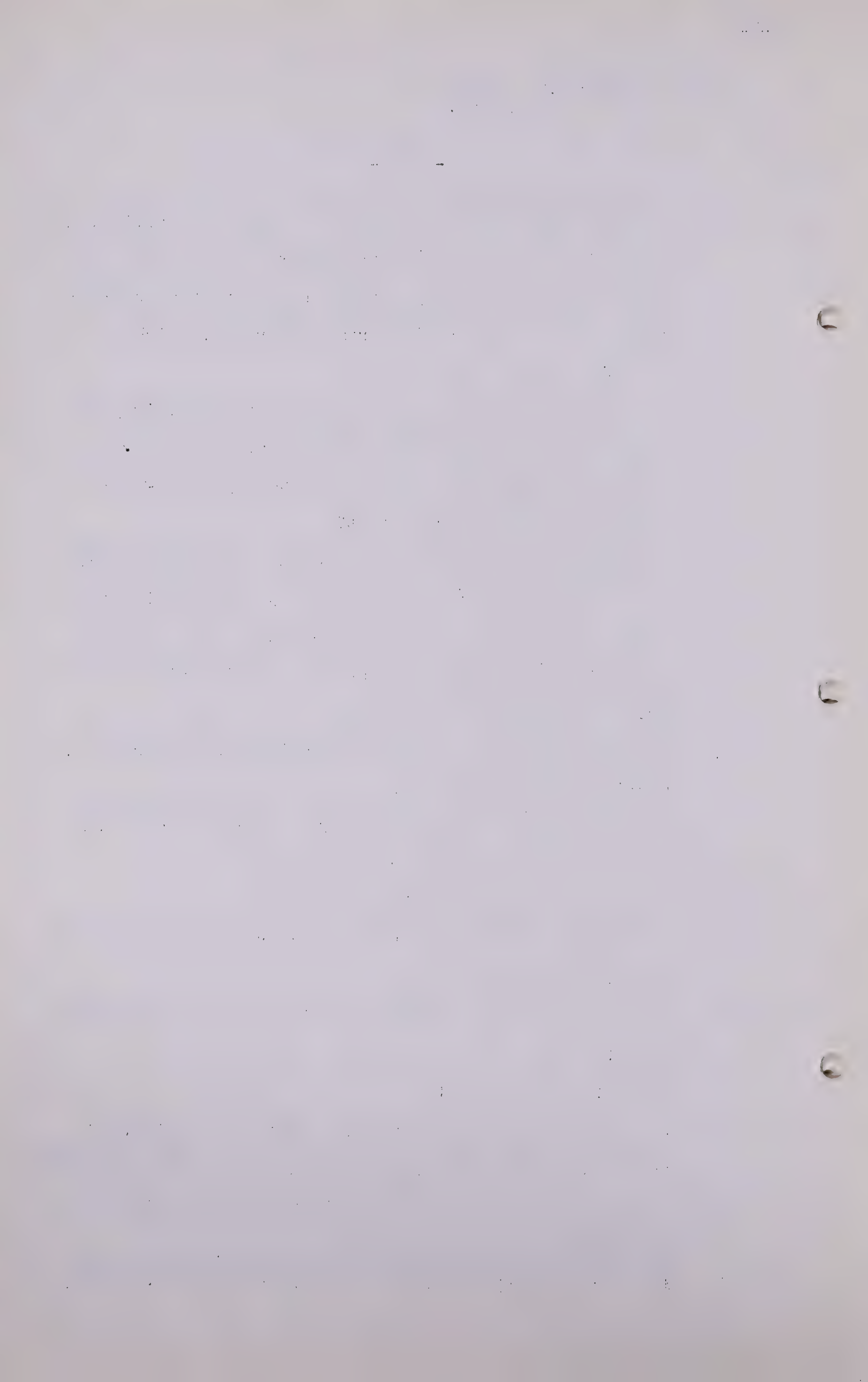
A Around the periphery of the proved area we have set out 8 or 10 wells . . .

Q Is there not a well almost immediately south of Ranfurly No. 1?

A Oh yes, I understand.

Q Let us take that as an example. That is in line, if there was a migration of gas, down to the older developed area, that would be of course in the general line of migration.

A If there was any production out of Ranfurly No. 1 well



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certainly there would be a lesser rate of flow in that immediate area than the closer Viking wells, which are closer to No. 1. That is a matter of testing.

Q And eventually if it is successful the migration in the entire area around . . .

A From the limited information we have it would indicate gas saturation of the whole field and with a pressure differential across at some time that gas is going to move.

Q I wondered whether or not in view of those so-called dry holes, whether it would not be fairer, possibly, to take some restricted area around Ranfurly No. 1 rather than extend the area as you do in Map 6. You still agree Map 6 is a proper indication?

A I would say it is more conservative.

Q Perhaps that is the correct word. It is a better word than "fair". It would be more conservative?

A It would be more conservative. Not necessarily correct but conservative.

Q May I refer you again to that transcript, and I am referring now to page 180, that is in Volume 3. Where at the bottom of page 179 Mr. Dougherty, starting with: "Q. Well then, Mr. Dougherty, let's take your Cessford area and take your exhibit 4 and 4(a)?

A. Yes.

Q. With regard to Cessford, you deal with it very carefully by wells, supposing you had that same material before the F.P.C. and you had to advise the F.P.C. about



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"what weight they should give to it. Now, tell me what advice you would give to the F.P.C.?"

A. I think we would recommend that we think there is considerable validity to the estimates, but --

Q. I am not saying that there is not.

A. -- but more wells should be drilled to prove up those areas which are shown as probable and possible. That would hold for any of the one or two-well fields."

A Yes, sir.

Q You think the last statement applies here to this Province and this situation?

A Yes.

Q And is not a different situation now?

A Our client has been attempting to follow that sort of recommendation with considerable success.

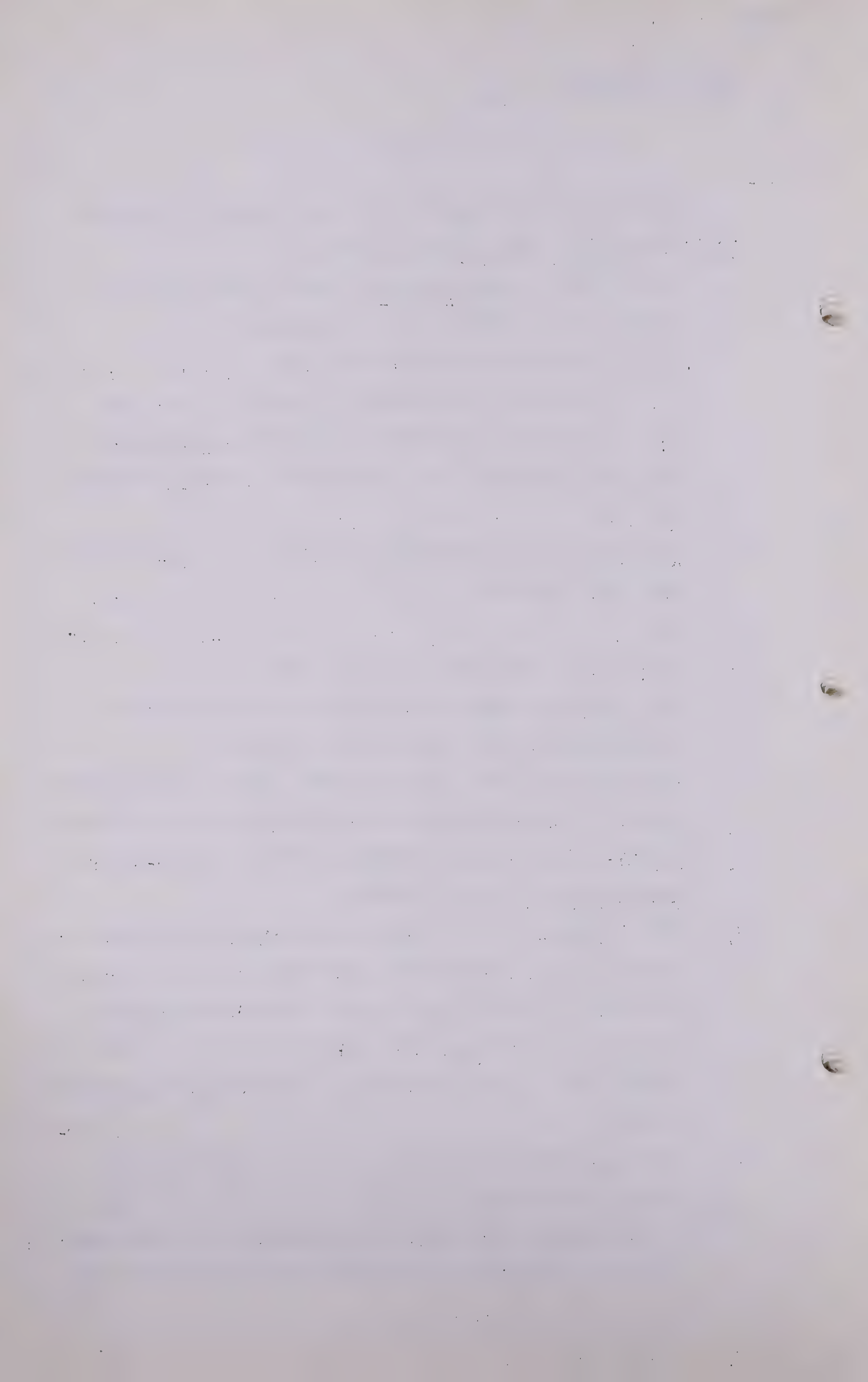
Q Yes, I know you have indicated that but generally speaking when you are dealing with these one and two-wells fields I want to know what you think the Board's consideration should be and not your clients'.

A That is true. We have attempted to keep our estimates within what we consider the reasonable geological interpretation of the one and two-well fields, keeping the proved to the drilling area and the probable and the possible to the wider extension in regard to the geological picture.

Q I am not criticizing?

A I quite understand.

Q I am thinking of the Board's consideration having regard to what, I take it, you would suggest to the F.P.C. and



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I think you say that the same suggestion would be made to this Board?

A Yes, at this time the first thing the Province needs most of all is development along that line.

Q That probably brings us to the next page which is page 182. There we have been talking about the possibility of, I think we call it the Foothills area?

A Yes, sir.

Q And about the second answer, or rather the first question on the page:

"Q. I don't suppose that Delhi thinks it is worth while to go into that area rather than two or three hundred others?

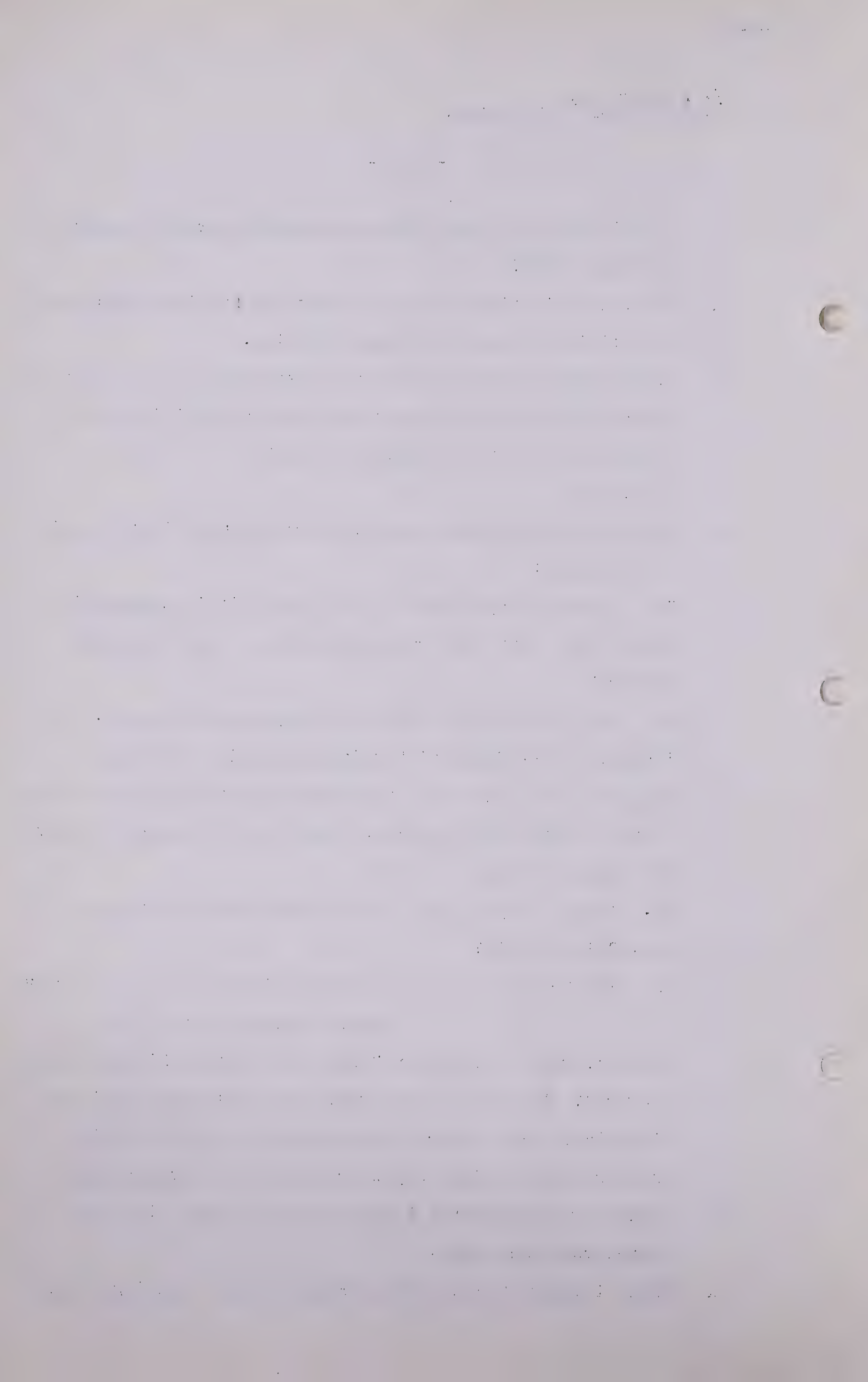
A. Yes, I think that has been very much discussed. As I remember Mr. Schultz' testimony the first day some suggestion was made that they move from the Plains province into the Foothills and Peace River in an attempt to prove up these reserves.

Q. I take it you agree to a certain extent with what Mr. Slipper said?

A. The Province does need another Pincher Creek or two."

Having regard to that last remark, what do you mean "does need another Pincher Creek or two"? Do you mean you would presently need or in the immediate future or can you explain it to us? As it stands someone might say we could not do anything here unless we had another Pincher Creek or two. I do not think you meant that.

A What I meant to say is that Pincher Creek, having a very



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high deliverability for the area to be developed and for the volume of reserves is a most desirable field from the standpoint of pipe line operation. Therefore, for the next 30 or 50 years the deliverability of the Province would be greatly added to by additional high deliverability fields in the Foothills area.

Q I am glad of that explanation because by itself somebody might interpret it as meaning that before the Board could come to any decision we will have to have another Pincher Creek or two?

A No, sir. I think Mr. Trostel's testimony with regard to deliverability will have some bearing with regard to the needs of the Province and deliverability.

Q The needs of the Province as you use the word here is something in the future?

A Yes, sir.

Q In other words you are not attempting to say that this Board just cannot, without another Pincher Creek or two, grant export of gas at this time or do you mean that?

A No, I think your interpretation is correct.
It would be very handy to have them in the future and I sure they will be developed if exploration can be fostered.

Q One question, we mentioned Ranfurly here a moment ago. I wonder would you refer to what we have called the Birch Lake well, I think it is United Dominion Petroleum No. 1, Section 14, Township 50, Range 12 on that same map you are referring to?

A Yes, sir.

Q And if my recollection of your information is correct,



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you referred to, I think, half a million from the Viking with respect to that well. Have you whatever data you need to check on whether or not this half million that is referred to on your data did come from the Viking sand? What I have in mind is someone has said that whatever came out of there would be a bit above and a bit below what might show on your data as the Viking sand.

A That is not my understanding of the data. However, the data is not of the very best.

Q I do not think my suggestion is of the best either, but I just want you to check?

A The records we have are as follows, this being a cable tool well drilled in, started in January 1921 and apparently abandoned in 1923. The first occurrence of gas was 200,000 cubic feet at 420, 422 feet below the surface. The second was 1513, 1515 400Mcf. Then at 1402 500,000 cubic feet; 2018 to 2028, 500,000 cubic feet. Then there are records of shows below that, running on down to 2322, the total depth of the well. We do not have the exact records. The impression we got is that some place in the vicinity of 1400 to 2000, which would be in the vicinity of the Viking sand we had gas in more volume, around 100,000 to 500,000 depending upon the gauge. The data is not good.

Q What I had in mind is just what you said, that somewhere in the vicinity of the Viking sand -- is there anything before you there from which you can tell us that that was your interpretation, it was out of the Viking sand? That is what I have in mind.

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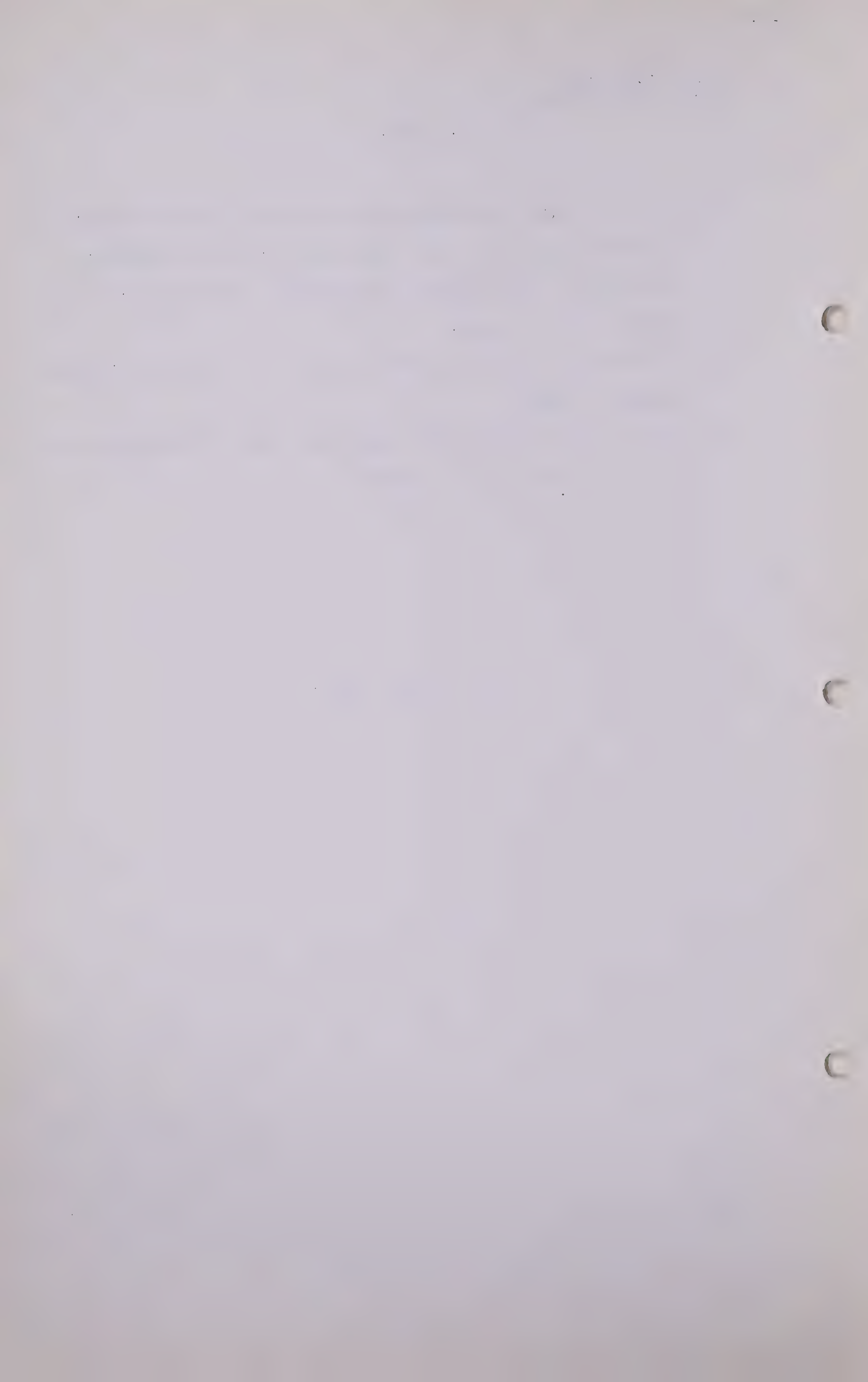
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A From our structural map and the elevation that was our interpretation that that field would be in the Viking sand area. Not having an electrolog or any control we cannot say precisely.

Q If somebody else has another idea it is a matter of interpretation again?

A That is the trouble with cable tool wells in that period of time. The data is limited.

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Q I wonder if you would look at what I call the Cessford area, division 5, map 10, I think is what I want to refer to. Have you the record of what might be called the northwest area? Maybe we could call it the Amerada area.

A Yes, sir.

Q And particularly with regard to Amerada, the northwesterly well, anyway?

A Amerada F-415?

Q Yes, that is it.

A Yes, sir.

Q And where there is a thickness, I think, of 9 feet given?

A In the Upper Blairmore, yes, sir.

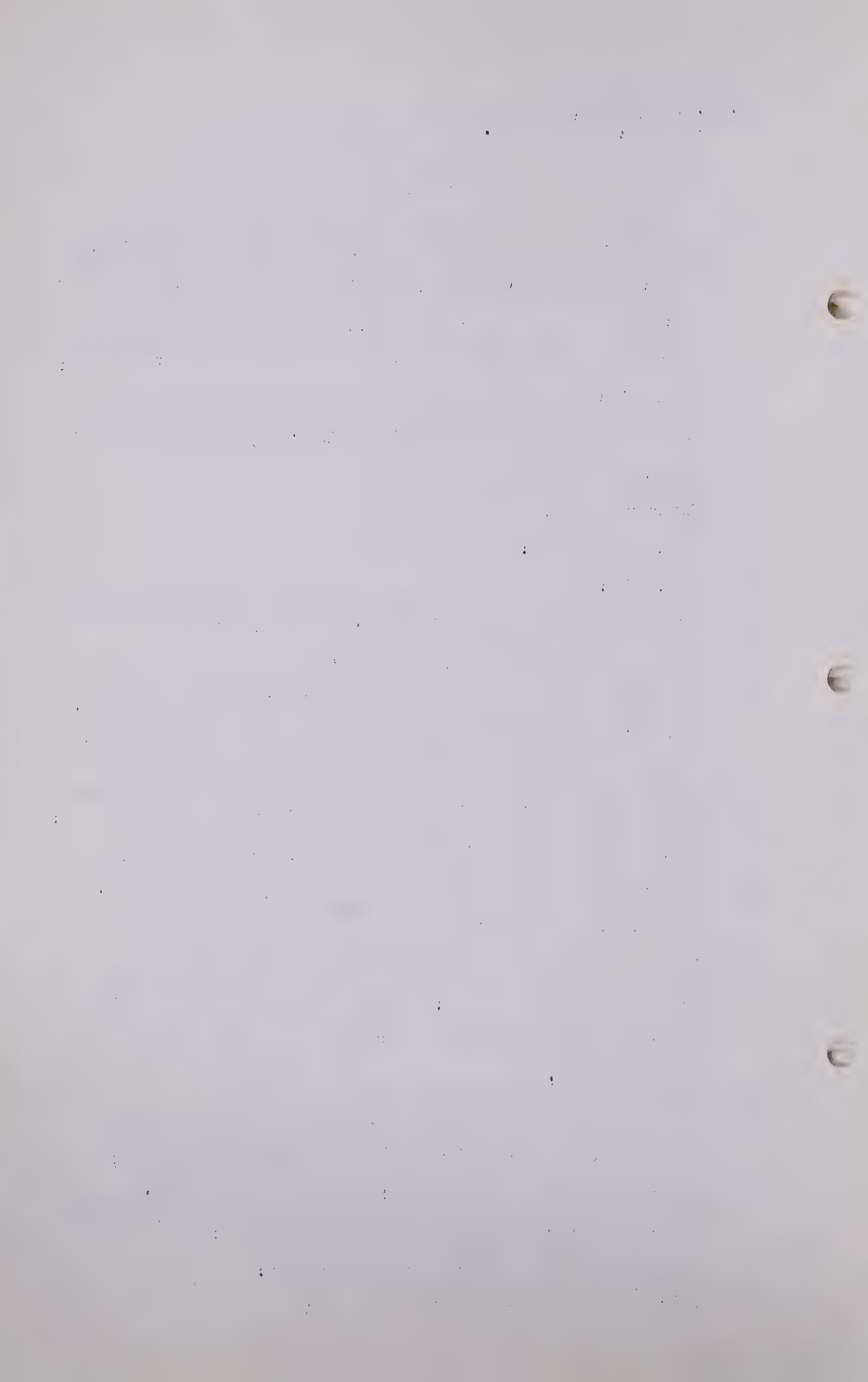
Q And what I wanted to get some information about is this, according to a suggestion made to me that having regard to the electrolog the sand there looks so wet that one might probably call it a water well instead of a gas well. Would you mind just checking on that, Mr. Dougherty?

A We are calling the top of the Upper Blairmore at 3364. The Amerada people cored from 3347 to 76 across that interval and had to circulate about eight days on account of the blizzard. They were never able to run a drill stem test on that portion of the sand due to that blizzard.

Q Does your electrolog help you?

A It correlates very nicely with the other Crown wells, according to my recollection. We will check that. The core record on the other one they cored, it indicated to them that gas saturation was present.

Q Which well are you referring to now?



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A The F-415.

Q But when you say the other well?

A The other Amerada Crown well 21-8-23, yes.

Q Does your electrolog help you to find out whether or not this sand is wet?

A You can not always tell precisely.

Q Can you give me any interpretation from it with respect to that?

A Well, I would prefer to check with the other well which we have good data on since they did not drill stem test this one.

Q Still, does your electrolog give you any help with regard to my suggestion, Mr. Dougherty?

A Only by intercorrelation between the two wells, the one well of known control and the other.

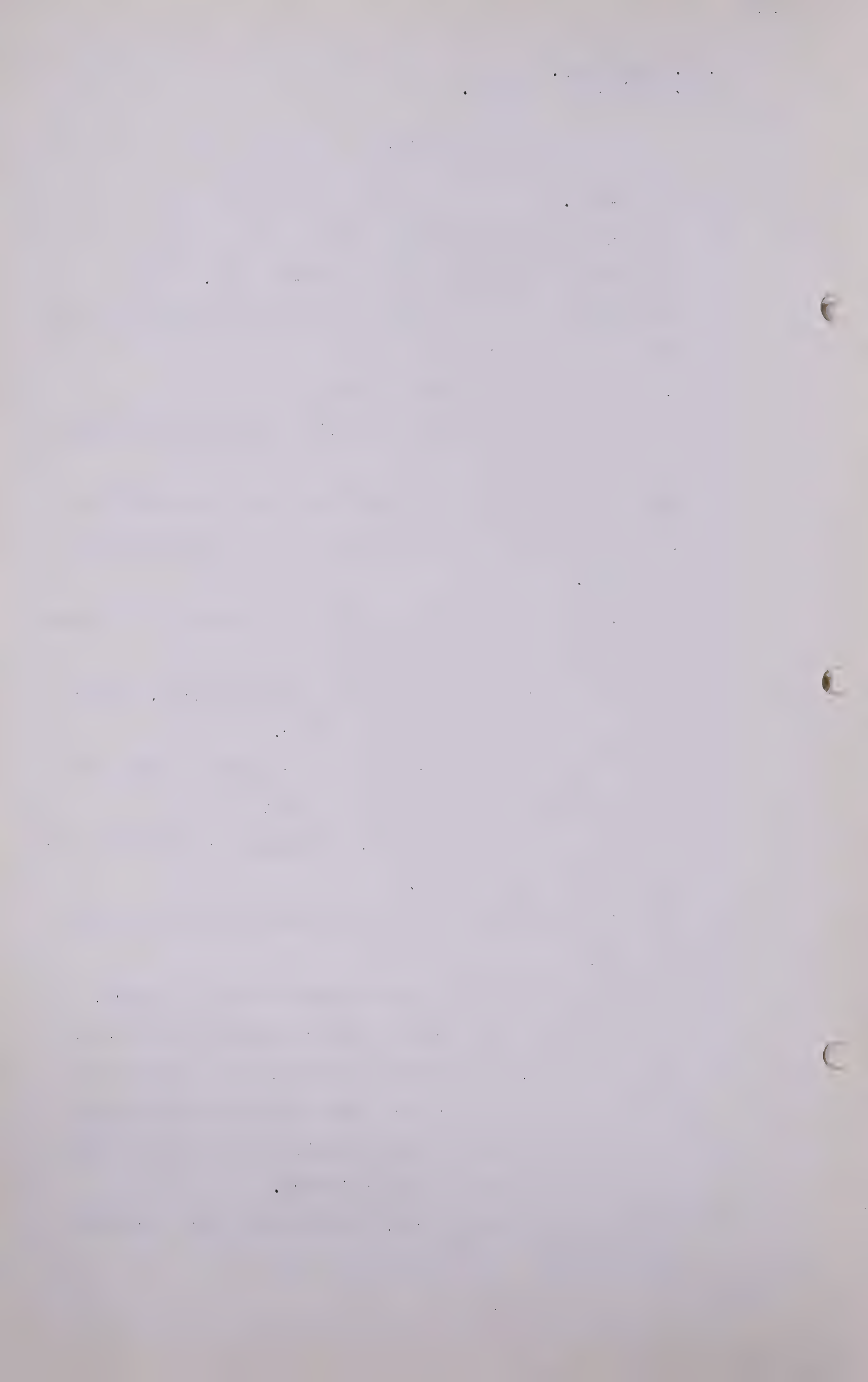
Q You mean, from the electrolog you can not get any idea as to whether it might be wet or not?

A You can get an indication but depending on the character of the mud in the hole.

Q What indication do you get from your electrolog on that top one?

A I would interpret the gas saturation with a contact, with a probable gas-water contact somewhere about 3375 plus or minus. Our primary basis was the observation of the Amerada core record that gas saturation in the cores was present but that no drill stem test was able to be taken because of the blizzard.

Q What are you reading from? Is this the core record of the company?



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A By Mr. Beach.

Q By who?

A Mr. Beach, Floyd Beach.

Q I want to ask you this, whether you do not think the occurrence of gas in the same well we are talking about might not be from the Basal Colorado rather than the Upper Blairmore? Would you just check on that, Mr. Dougherty.

A Well, I mentioned that problem of correlation earlier, that the Upper Blairmore sand so-called in this area might be Lower Colorado A or B. That would hold for all the so-called Upper Blairmore here, a matter of correlation. It is the same sand uniformly across the area so that it would be a matter of correlation. The cross-sections we constructed through the field show a very nice correlation for the horizon we are calling the Upper Blairmore. If someone wanted to call it the Lower Colorado it would not upset me very much.

Q "If someone"?

A Wanted to call it Basal Lower Colorado it would not upset me much, it is just a name.

Q All right, I did not hear the last two words. Now, Mr. Dougherty, I wonder could I take you back again to what we call the Morinville area. Map 14 of census 14, I think, is probably the one you want.

A If I may delay just a moment. Yes, sir?

Q I think map 14 of census 14 is what I want you to refer to, and having particular reference to the Royalite

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Peavey well, Section 29, Township 56, Range 25, I think.

A Yes, sir.

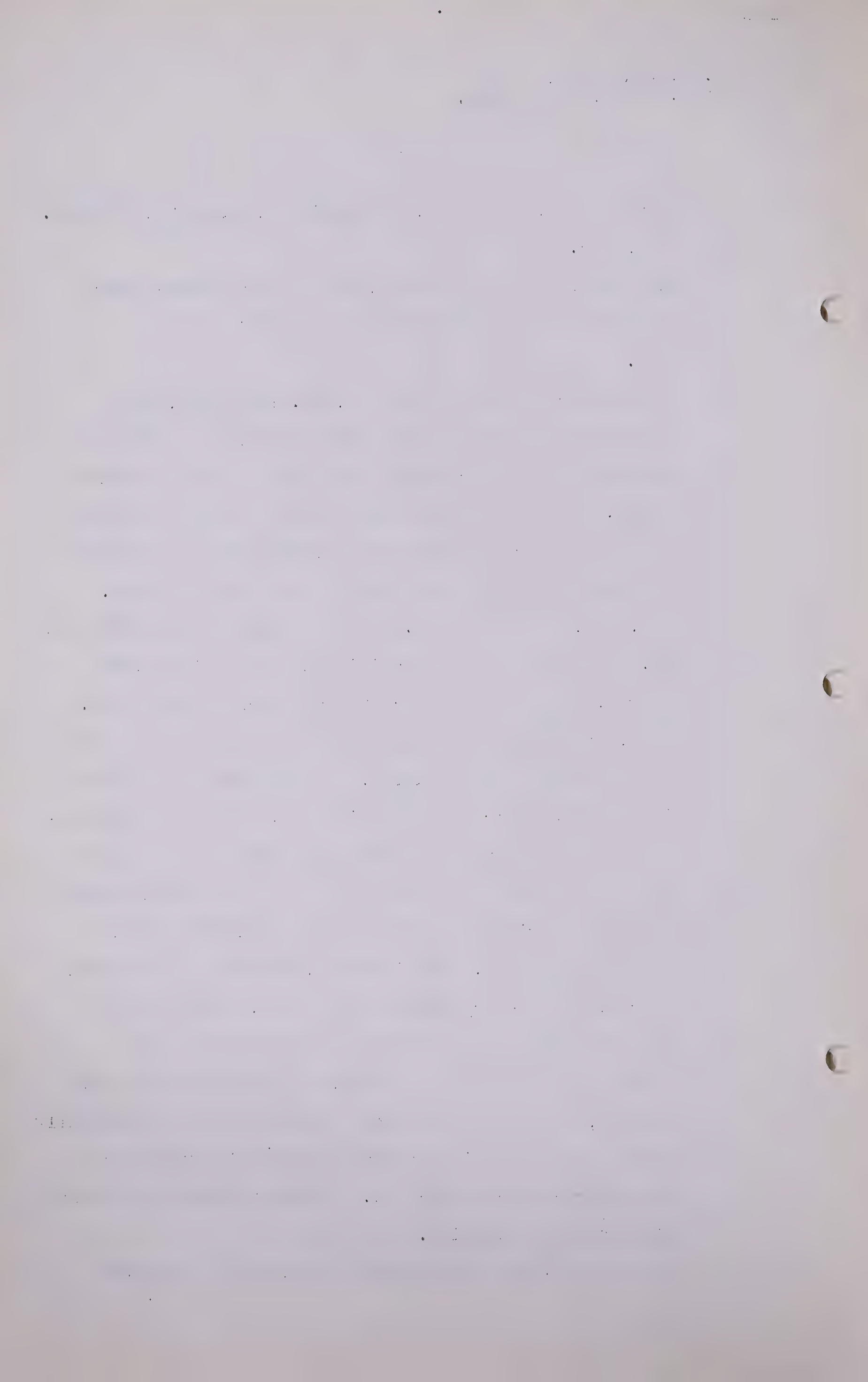
Q And that, you will observe, is in your probable area more or less on the western side of it?

A Yes.

Q I am referring to the map now, Mr. Dougherty, and according to a note I have here the test on that well showed 100 Mcf. increasing to 50 and 800 feet of salt water. I wonder if you would check your notes and see if that is correct and then tell me whether or not you still would like to have that in the probable area.

A Yes, sir, I still would. That test was between 3430 and 48. That is in the Glauconitic sand above the Basal Quartz, this Lower Cretaceous map which we show here. Also, the Cretaceous sand map is for those sands below the top of the Basal Quartz. We have made no estimates in the Glauconitic sand in this area. We think considerable sand has not been tested in a number of wells but that well was not tested in the top of the Basal Quartz where the Morinville and Legal and Cardiff wells are getting their gas. The interval, the top of that Basal Quartz, on our correlation is at 3545, approximately 100 feet below that test, and the electrical log correlations with the other wells is excellent in this horizon, and so far as we are concerned it is essentially proved gas saturation in that horizon with very nice gas-water contact indicated. I have no doubt in my own mind of gas saturation.

Q The test I refer to then does not apply to the sand



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which you have reference to when you put in probable,
is that correct?

A That is correct. It is unfortunate but a number of the
Glaucconitic sands above the Basal Quartz and the Basal
Quartz in a number of wells in that area were not drill
stem tested. It looks as if there might be additional
amounts of gas saturation that are indicated but we can
not get our finger on it in the sands above the Basal
Quartz.

Q Well, I think you have explained probably what bothered
me, if I can use that expression.

A Yes, sir.

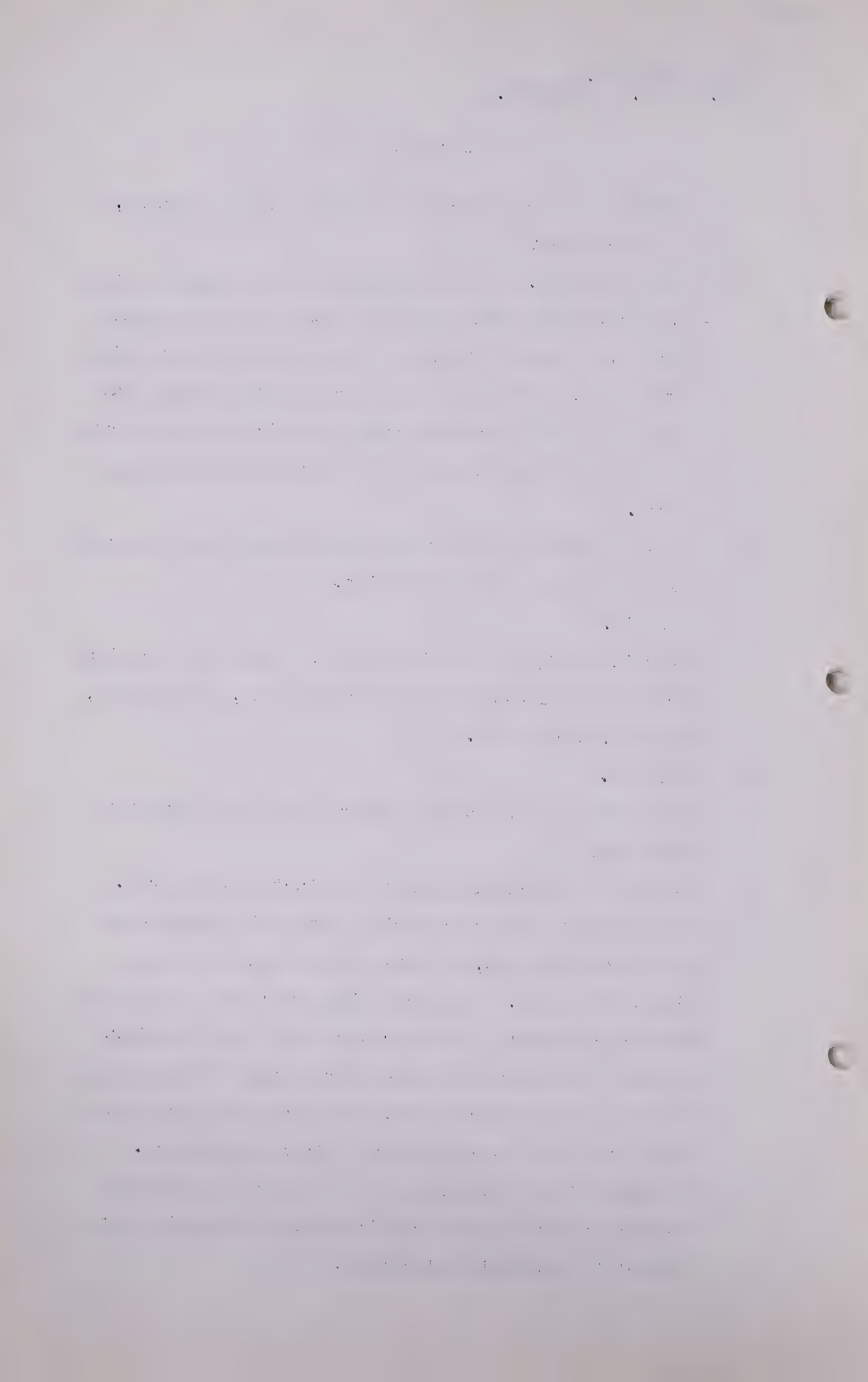
Q Referring to Ajax Morinville No. 1, I have the location
here but you undoubtedly know where it is, Township 56,
Range 23, Section 14.

A Yes, sir.

Q And I take it you placed a water table with respect to
that well?

A We have an indicated gas-water contact at 3567 or 8.
The basis of that is the drill stem test between 3556
and 68 reporting 35,000 cubic feet of gas in a very
tight, thin area. The succeeding drill stem tests from
3568 approximately to 78 recovered 290 feet of water,
so that we estimate the gas-water contact as previously
stated to be at approximately the depth at which those
drill stem tests succeeded each other in sequence.

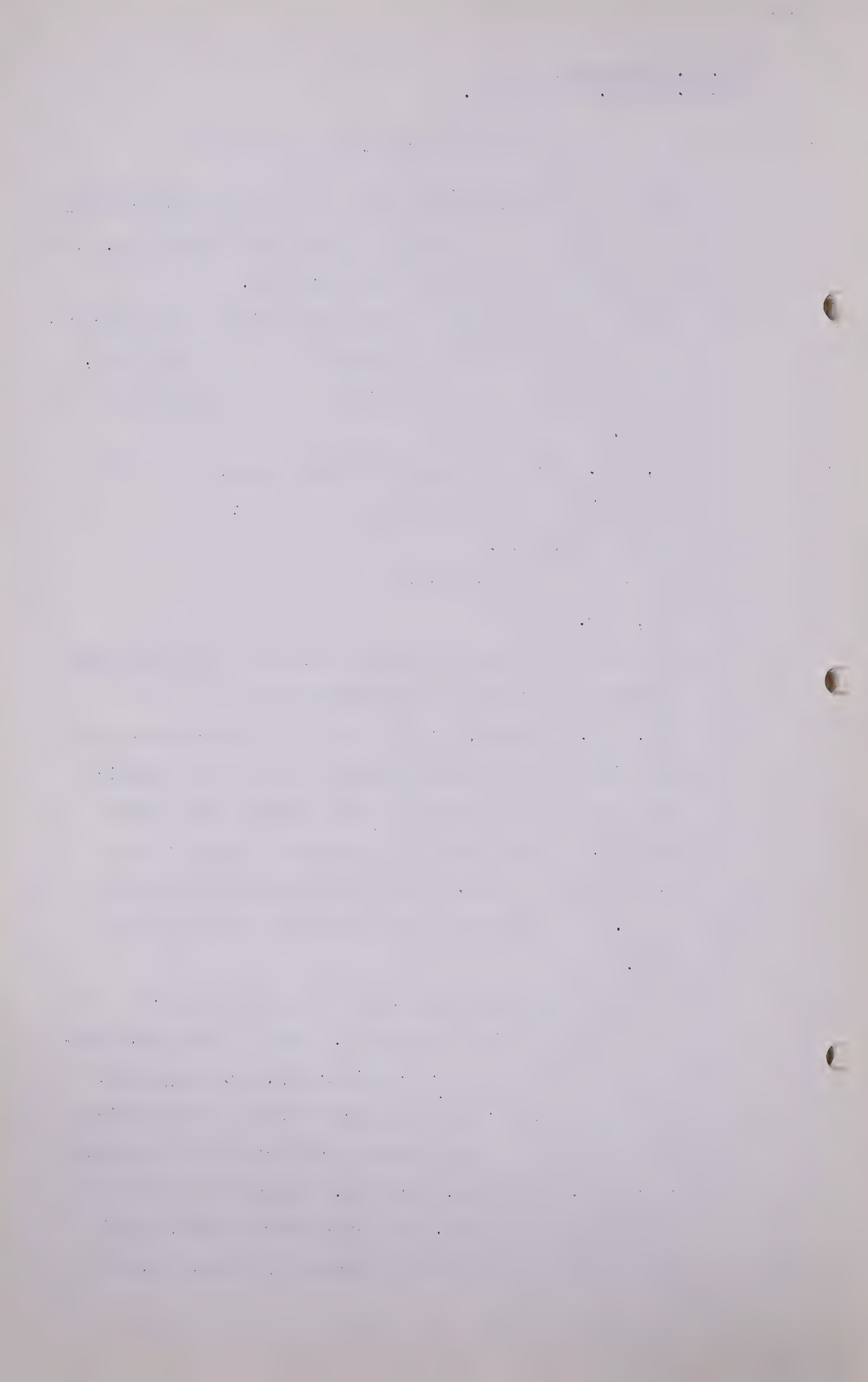
Q I wonder if you would look at your electrolog and see
whether or not you have confirmation or otherwise with
respect to your drill stem test.



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- A Not too closely, because the section is broken and shaly so that the resistivities I am not too definite on. We would base that on the drill stem test.
- Q What I have in mind is, some are looking at the electro-log and somebody else looking at the drill stem test, and they might get quite a variation in their water table.
- A Oh, yes. That is a matter of experience.
- Q You estimate it on the drill stem tests?
- A Where we have it.
- Q But in this particular case?
- A Yes, sir.
- Q And does that apply throughout all those various wells in that same field we are discussing?
- A Yes, sir. However, if you have some good control and can find the sand well developed without the conflict between the resistivities of the broken shaly sand section, we have found the gas-water contact to be fairly well evident. It does not hold for all of the wells. We took some interpretations on a number of them.
- Q You may remember enough about this, with respect to all of the wells in this same area, isn't it true your gas-water table varies very considerably, Mr. Dougherty?
- A We found a rather good sequence of water tables which were inclined to one gas-water contact so far as we are concerned. That was, inclined, dipping from the northeast to the southwest. The gas-water contact in the Cardiff area is at a lower sub-sea elevation than the



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gas-water contact in the Basal Quartz in the Imperial Morinville No. 1 and in the Imperial Morinville No. 2. However, structural studies indicated that this accumulation of gas in the Basal Quartz is on a large nose-in structure that is probably a function of the dropping to the Cretaceous area, so-called, Morinville reef, which was drilled into by the Imperial Morinville wells.

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Q Yes. Well, in ordinary circumstances, if there be such in this game, where you have variations in water tables such as, I think, possibly appear here, would you ordinarily say they are different fields or pools, or whatever you want to call them?

A No.

Q Isn't that an indication that that is all it is?

A No, because if you take and make cross-sections, and are to look up the electrölogs and see the position of the gas/water contact in this Basal Quartz series, and that chaos which you would infer by looking at the individual wells....

Q Yes?

A ...and you need a reasonable reservoir pattern of the updip wedge-out of the gas/water contact against the top of the Quartz sand at the north end of the field, and this nosing structure, and that is fairly typical of this type of a stratigraphic trap, as this is, in our opinion.

Q Can you describe it generally, how it goes through the field, Mr.Dougherty? Do you know what I mean?

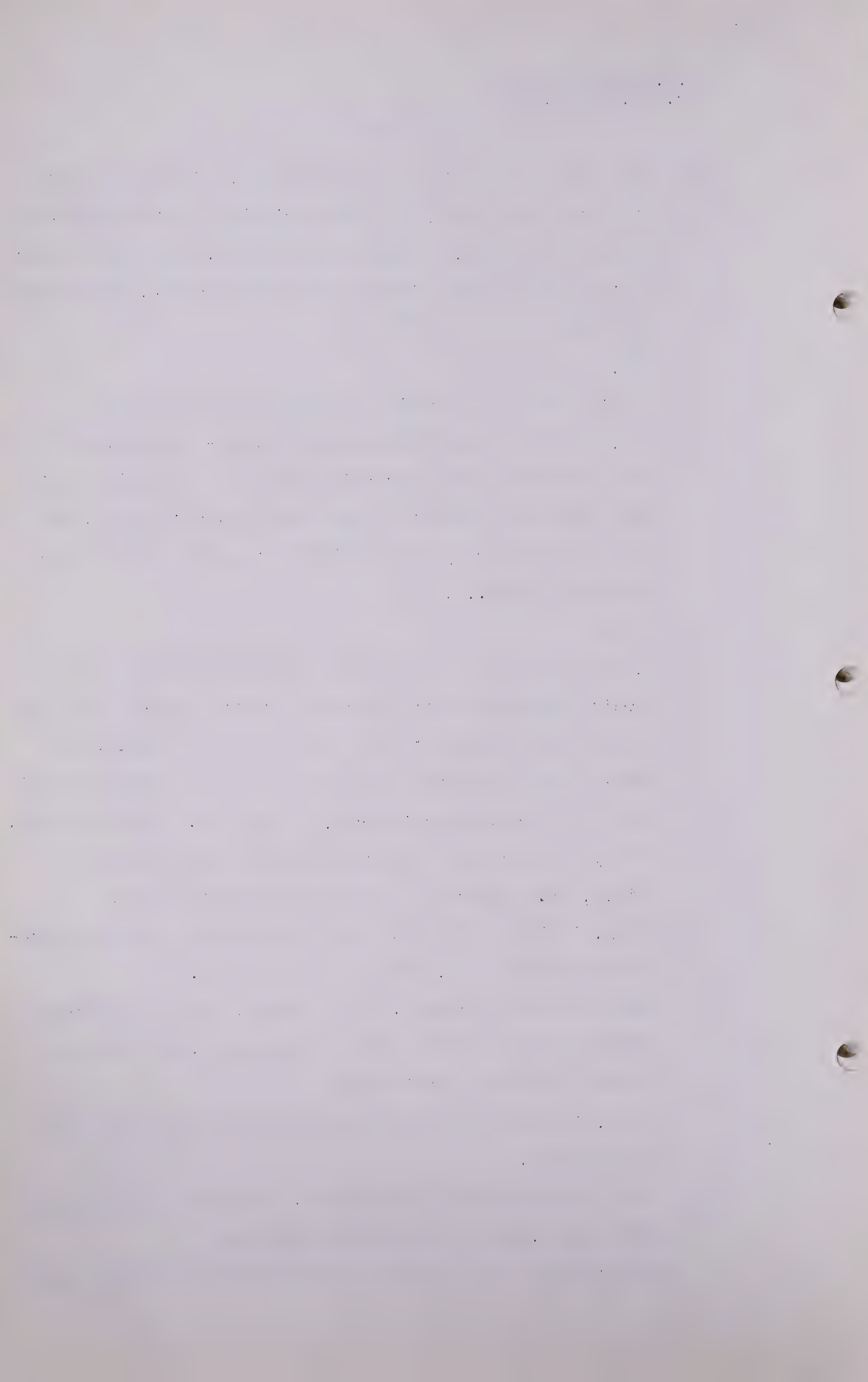
A Well, it is a - I could draw a picture on a little blackboard we have here, if it be of interest.

Q That would be a change. Do you mind? One of my friends suggests that we might solve it this way, how much does it vary throughout this field?

A Well, it would take me a minute or so to pull out a few of the logs.

Q I see the blackboard is in here. I was not too serious about that, but I see it is in here now.

A We have done a lot of work and we get pretty serious about



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it, and I think Dr. Govier and myself might have something to use that blackboard for anyway.

Q In some of his various duties he might be familiar with it, I mean the blackboard.

A I assure you that this blackboard idea was an afterthought. We had not thought of this a long time ago.

Q Well, some of my friends here might like to see it. I was not too serious, I am afraid, at first. You do not mind if I sit down in the meantime, sir?

THE CHAIRMAN: Well, maybe Mr. Dougherty would like a few minutes to get things in order, and we can adjourn in the meantime.

A Yes, sir, it would be much appreciated.

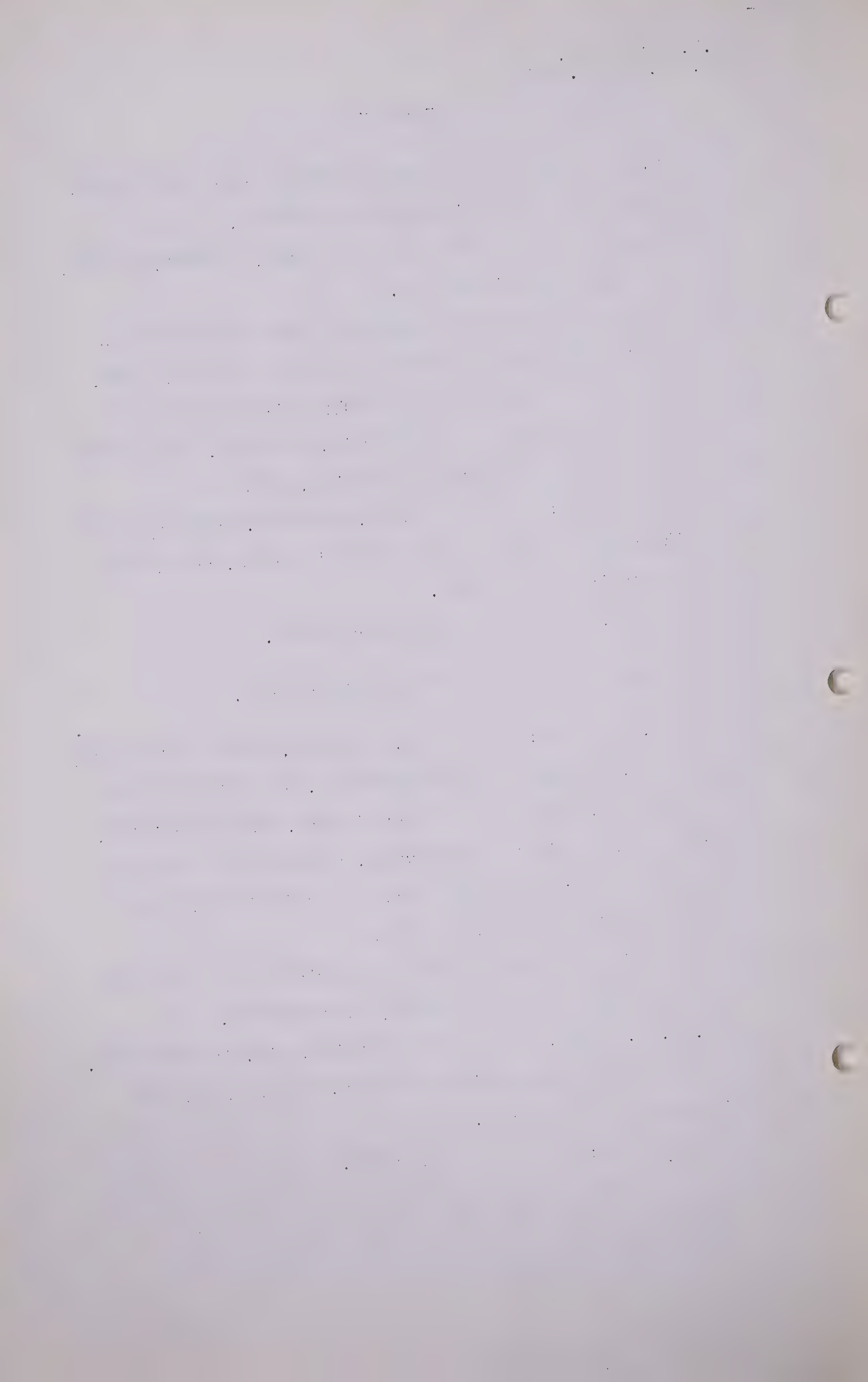
(Hearing resumed after short adjournment).

MR. C. E. SMITH: Mr. Chairman, after a discussion with Mr. Howard, the Court Reporter, he advises me that this board, not the blackboard itself, but a facsimile, can be placed in the transcript, and probably that would be a good idea if counsel agree. I take it Mr. Dougherty will describe the board anyway?.

A I was going to suggest that by description we have that it could be reproduced mentally or otherwise.

MR. C. E. SMITH: If you think, sir, it advisable, the Court Reporter advises me he can put it in as an insert in the evidence.

THE CHAIRMAN: All right.



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S	1	1	1	1	N
Cardiff	Morinville No.2	Morinville No. 1	Waybrook		
				* <u>-1034</u>	
				ø <u>-1069</u>	
* <u>-1253</u> (b.q.l.)	<u>-1207</u> (b.q.l.)	<u>-1230</u> (b.q.l.)		Water	
ø <u>-1332</u> (g.w.i.)	<u>-1277</u> (g.w.i.)	<u>-1300</u> (g.w.i.)			
Water	Water	Water			

Legend: * - Green - Basal quartz line (b.q.l.)

ø - Blue - Gas/water interface line (g.w.i.)

Q Mr. C.E. SMITH: Will you continue, Mr.Dougherty?

A What I had reference to particularly was the remarkable uniformity rather than the variation between the top of the Basal Quartz sand, which I have utilized in my own mind on the map, in our work maps, as the so-called Green point of the correlation. The diagram on the Board, I think, I have utilized the top of the Basal Quartz sand as a green mark with the chalk with the sub-sea elevation immediately above the top of the Basal Quartz marker. The gas/water contact as determined by electrical logs and drillstem tests has, on the board, been designated with a blue chalk line with the subsea elevation, and that point above the blue line....

Q May I interrupt you one moment? I think, as a matter of record, I think you had better describe the top, giving the North and the South, and I presume those are the names of wells on there?

A Yes, sir. I will do that. I had intended to.

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Q I am sorry, I did not know?

A This is, in fact, what we visualized in the Legal-
Morinville area, a North-South cross-section from the
Imperial Waybrook well in Township 57, Range 24, West
of the 4th, with the top of the Basal Quartz sand as
-1034 feet, the top of the gas/water interface at
-1069 feet. Proceeding southward toward the Morinville
area, proceeding southward, I mean, toward the Morin-
ville area, in the Imperial Morinville No. 1 well in
Township 56, Range 24, West of the 4th, the top of
the Basal Quartz is -1230 feet below sea level, and the
top of the gas/water interface is at -1300 feet below
sea level. Proceeding southward to the Imperial Morin-
ville No. 2, in Township 56, Range 25, West of 4, the
top of the Basal Quartz is -1207, the top of the gas/
water interface is -1277. The Imperial Morinville No. 2
is apparently at the crest of the draping of the Lower
Cretaceous over the Morinville reef. There is apparently
a very slight indication of closure between the Morinville
1 and 2 at the crest of the reef, a matter of 23 feet over
5 miles, a very low rate of dip, practically^y flat. It
is approximately 5 feet per mile, which is one degree dip
in....

Q MR. GOODALL: Hardly 5 miles, is it?

A About 4 miles, $3\frac{1}{2}$ to 4 miles, and that into 23 feet is
6 to 8 feet per mile, and that is a tenth of 1%, a tenth
of 1° dip and it is so flat you could not see it by
looking across that surface.

Proceeding then southward to the

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Cardiff Giant well in Township 55, Range 24, West of 4, the top of the Basal Quartz sand, it is at -1253, and the top of the gas/water contact is -1332. The board is too short to show the Imperial Qui Barre well, which is in Township 55, Range 25, West of 4, in the southwest corner of the township. The top of the Basal Quartz sand is -1339 feet as compared with -1253 in the Cardiff Giant. The top of the gas/water contact is approximately 1534 as contrasted with the -1332. This gas/water interface is within the same series of sediments, and when the gas/water interface is approached, the electrical log has the usual characteristics indicating increasing connate water saturation by the movement of the resistivity lines with regard to the second and third curves to the left, until the actual gas/water interface is reached. This appears to move toward the left on the electrical log almost irrespective of the shale breaks, and self-potential sands. Our interpretation is that the top of the Basal Quartz series is one reservoir, with minor reservations due to shale breaks which apparently do not affect the total gas/water accumulation.

Further to the North, and off our diagram, control would indicate in the Pacific Thornchild, or Thornhild, I guess it is, in Township 49, Range 24, West of 4, in Section 22, the top of the Basal Quartz is at -851 feet, and that is 10 miles north of the Waybrook well, and a third point the entire Basal Quartz sand is water-saturated, so that we have a North pinchout of the gas/water interface against the top of the Basal Quartz

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sand. We have that with the gas/water accumulation dipping to the south from the north on this broad structural feature, which is a combination of a structural nose with a slight doming structure in the vicinity of the Imperial Morinville wells Nos. 1 and 2. That is the basis, that interpretation study is the basis for our conclusion that the gas accumulation is essentially one, and that the variations indicated by individual examinations of wells, which might lead to the conclusion of individual gas accumulations, is, in our opinion, not borne out by the regional picture, the correlation being so good between the sand in the Basal Quartz and the position of the gas/water interface on this structure. I believe that covers it.

Q MR. GOODALL: I do not think I understood that, Mr. Dougherty. Would you mind, with your imagination and similar data, show how this could be, or how those could be separate structures, separate accumulations, and that would be much simpler, wouldn't it?

A We do not have any evidence of major dip and closure in between these wells on the structure. We have no evidence of a series of highs and lows strong enough to intersect that gas/water interface. The uniformity, also, of the interval. This then, oh, it ranged about 75 to 80 feet, plus or minus, suggests, or, rather, that uniformity in itself would make the occurrence of the uniformity on a series of 5 or 6 structures as being a little bit too good, small structures, that would assume the same accumulation area for the accumulation of gas or water for each

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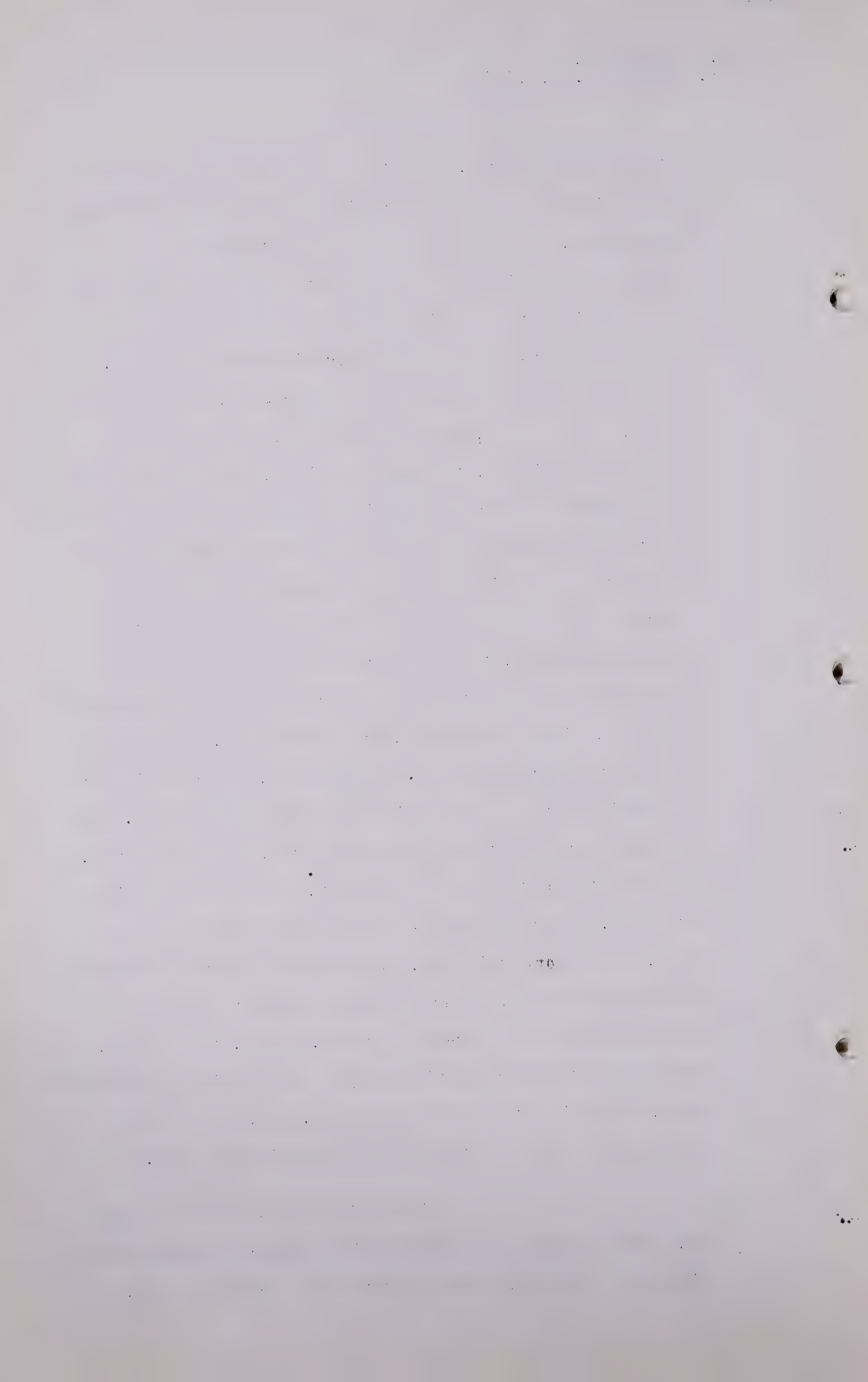
- 634 -

of those structures, such that you would have about the same thickness of gas saturation on isolated individual structures. That is a little too fortuitous.

Q Would it be a little too fortuitous that you would have the same interval on different elevations?

A That is typical of all large stratigraphical fields. That particularly refers to the largest stratigraphical field, a gas field, and is a gas field with which I am well acquainted, the Hugoton Field, and it has almost the identical configuration in a cross-section from west to east in which the gas/water interface approaches the top of the producing Dolomite sand as you get at the extreme edge of the field, but in the central part of the accumulation, the distance between the gas/water interface and the top of the Dolomite series approximates 100 feet, with very minor local variations, and as one of the same permeability or continuous, the porosity and permeability as developed in the Basal Quartz sand. They are good sands in this particular area. It would take, I think, to appreciate the concept, whether it is right or wrong, you could string out all the electrical log data, the electrical logs, and take the characteristics of the sands and the gas/water interface to see the uniformity in the over-all picture, which, to my mind, precludes isolation particularly of the Morinville-Cardiff area, where it is a continuous area, or where we are thoroughly convinced that it is a continuous area.

You will note on our map, page 14, that we have not connected the Legal-Waybrook wells with the Morinville wells except by a possible area,



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although in my own mind I am convinced that there is no major structural drop-off indicated north of the Morinville No. 1 well, between that and the Waybrook.

Q But I do not understand your explanation of why the water is higher at the Thornhild well, there is no gas accumulation there at all, the water fills the entire sand, and it is a higher elevation?

A That is the updip pinchout of the gas accumulation.

Q Why does the water work up?

A It does the same thing in the Hugoton Field before you have lost all porosity in the Dolomites and limestone, and you have a 100% water saturation at an elevation of 9 feet of the gas/water contact on the east side of the field. It is a function, in my interpretation, at least, of the total volume of gas available to saturate this structure. It is the relationship between the permeability and the porosity in the sand. In other words, I would visualize the accumulation of gas in the Lower Cretaceous as occurring wherever there was a sufficient of an anomaly, either a terracing or a structure developed which would trap the gas, then the volume of gas saturation in there would be directly related to the volume of the shaded area, in effect, of the accumulations surrounding that structure, whatever it is. If there was enough, the position of the gas/water interface would be determined by that, and if there were no structures, no others, then the Legal-Morinville area, having Lower Cretaceous gas, and assuming it had a very wide drainage area, and we would have, perhaps, instead of 70 or 80 of an interval between the top of the sand and the gas/water

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interface, we might have 150, but we know there are other water accumulations in the Basal Quartz which have sopped up their portion of the total gas available for the Lower Cretaceous. That is the reason that we have shown this picture, attempting to visualize not just the well control, but what has been the geological history, the regional history, and why the gas got to there.

Q You couldn't imagine an entrance to one of those wells, an irregular sand body?

A The Basal Quartz, although broken with some shale, is quite uniform, is quite a uniform body when we string out the electrologs.

Q Have you seen the cores?

A No, I have not. We have the core analyses of the great majority of them.

Q The fact that there are some shale breaks in the sand would indicate that there was not a continuous sand deposition?

A It is difficult to correlate shale bodies precisely. In other words, they will develop in a local area, they will not coalesce and may interfinger in different ways in the reservoir.

Q Is there any reason why the sand body would not accumulate?

A It is quite uniform, actually, that Basal Quartz series.

Q As a series?

A Yes. And I would like to make particular reference to this Imperial Qui Barre well, because the indications on the electrical log of the gas/water interface and the progressively decreasing resistivity with similar self-potential as the gas/water interface is approached which,

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in the industry, is considered as marking increasing connate water saturation, and increases as you approach 100% water saturation, is a function such that the gas/water table crosses with very minor variations these sand bodies with small shale breaks as if the shale breaks had no effect upon the reservoir, as is our opinion. It is subject to interpretation. This is our picture of it.

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Q DR. GOVIER: Maybe you could help me a little on the same matter. It is my understanding of what you have said - let me give it to you and then you will kindly correct me?

A Yes, sir.

Q That originally there was a broad stratigraphic trap with 100% water saturation?

A Yes, sir.

Q Pinching-out to the north in the vicinity of the Qui Barre well?

A The sand does not pinch-out?

Q The sand does not pinch-out?

A No, the gas-water interface. The top of the sand does extend up at least to Qui Barre.

Q Extends at least up past Weybrook to the north?

A I was talking about the sand before the gas accumulation. The sand extends at least to Qui Barre.

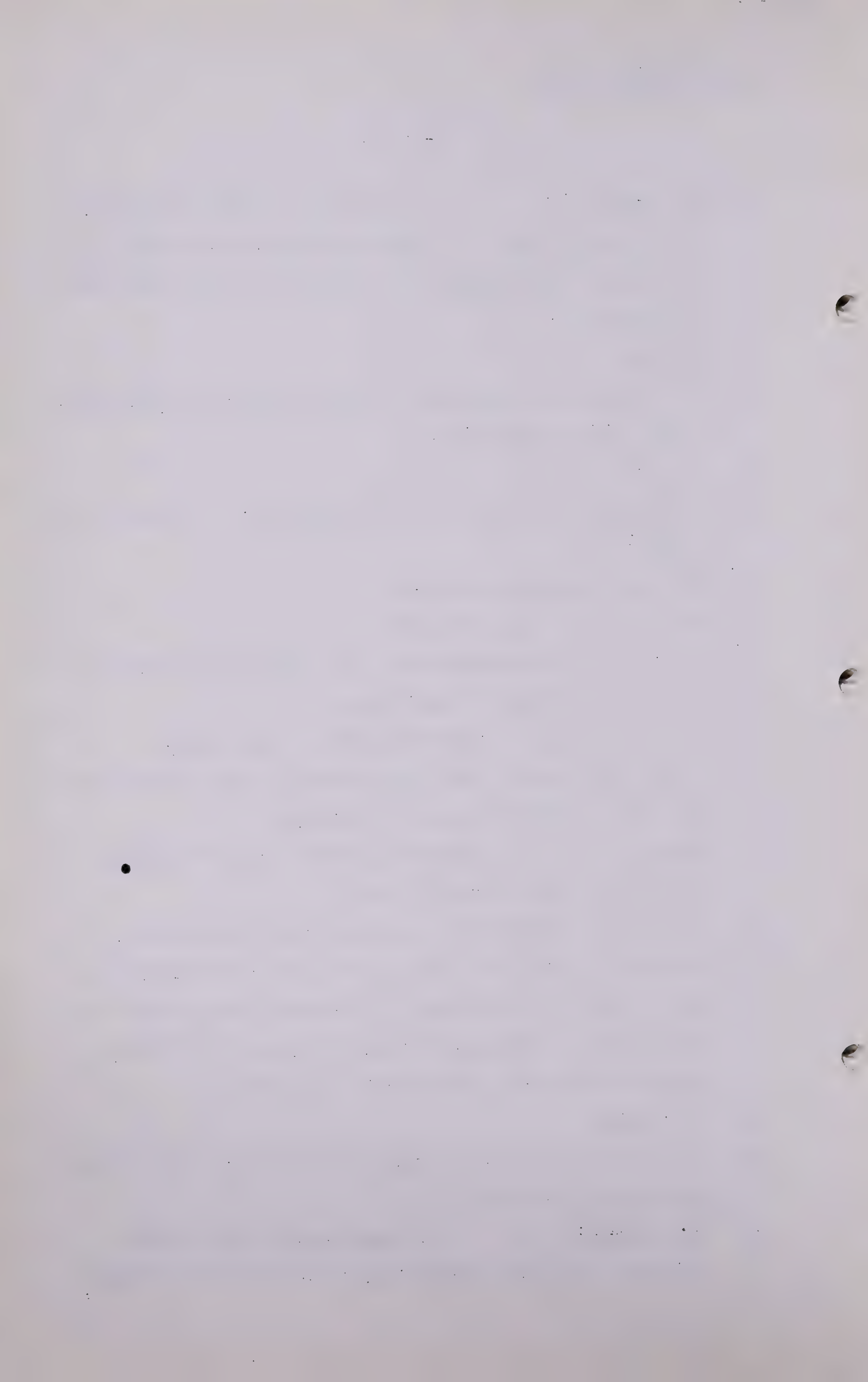
South at least to Qui Barre and North beyond Weybrook at least to the Thornchild well?

Q Is it your thought that gas migrating from some sort of material reached this trap but in a limited amount and only in a sufficient amount to saturate the portion you have shown as being gas saturated sand in a sufficient amount to displace the water in the sands?

A Yes, sir.

Q I do not know that I can say I understand it but I know what you are saying.

Q MR. GOODALL: I might carry that a little further. The sand deposition, it was not your thought,



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was it, that the top of the sand when deposited was a level plain?

A Essentially so.

Q Could it not have been undulating and sand bars with currents?

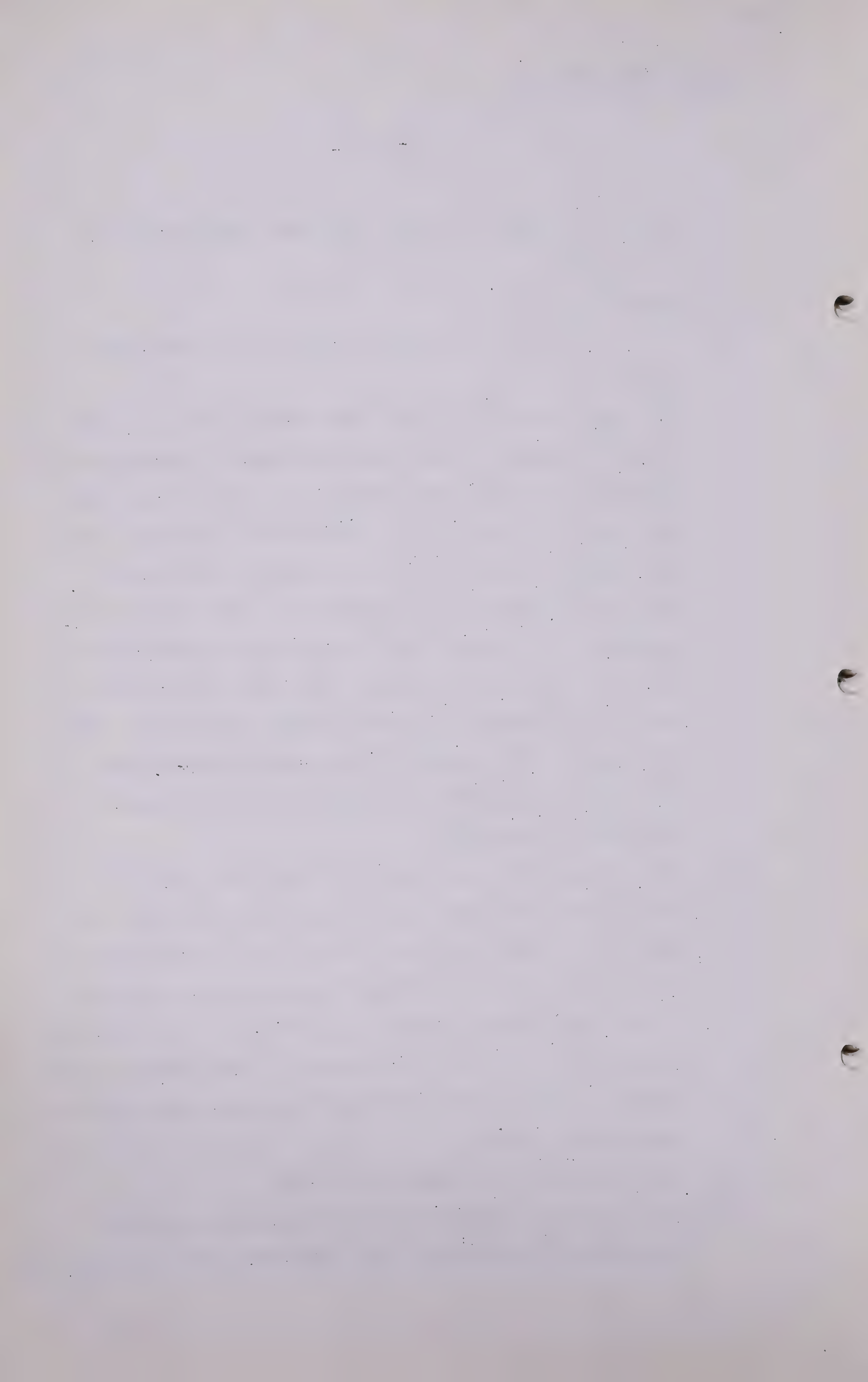
A The gross interval and the character of the Basal Quartz is quite uniform. There would be areas of slightly more development of shale and other areas with a little more development of sand. The uniformity is remarkable for the length of the area and the breadth of the area. Most of the deposition is quite flat. The present configuration is a drape over the Morinville reef with the dip accentuated at the south end of the reef in the vicinity of Cardiff Giant and the Qui Barre well. Then the regional dip proceeds north towards Weybrook and Thornhild or Thornchild well with insufficient gas to saturate the sand 100%.

Q And that gas only saturates the top of the sand?

A The gas trap is formed at the top of the sand with the drape to the east and west over the reef and with the drape south over the reef with the change in character of the Basal Quartz being a regional dip. The flattening is sufficient to slack the closure in the vicinity of the Morinville Wells 1 and 2 to form the focal point for the accumulation of gas.

Q And to displace the water in the dip?

A Yes, sir, it would displace it in the most permeable portions of the reservoir where the drape was at a maximum.



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There are many areas in the Province with long dips.

Q Is the top of the sand most permeable?

A Not necessarily. Parts of the sand would be more permeable than others but the total sand body would have a variation in permeability from top to bottom. Apparently with even a small gradient gas accumulations occur. Many fields in Wyoming in the Cretaceous sand are on very slight dips and merely a slight flattening in a regional dip will cause oil and gas to accumulate.

Q DR. GOVIER: What is the total thickness of sand accumulation? Is there any data on that?

A It is variable ranging between in the Imperial Morinville approximately 180 feet in thickness and that points up one of the things I have mentioned. There is a fairly big shale break that might run up to 5 or 6 feet in the upper one-third of this well in the Basal Quartz in Imperial Morinville 1. There is gas saturation throughout that upper portion of the sand and then below that shale break there is gas saturation for the uppermost 28 feet. Then the thickness of the Basal Quartz below that point is all water saturated. So that we do not have a separate gas-water interface in the upper portion of the sand but we have apparently when correlated with other wells to the north and south a continuous gas saturation. To the south the Qui Barre well has a gross thickness of Basal Quartz that runs from 3640 down to 3770, about 130 feet plus or minus. There are minor variations but the total sand body runs between 150 and 200 feet of the Basal Quartz with the amount of gas saturation staying fairly close in the gross interval

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of 70 or 80 feet.

Q What about that northernmost well, Pacific Thornhild?

A That might be a little difficult to run down. We have called that a wildcat outside of any field limits but I have a notation of the top of the sand and that it is water saturated, so I do not have available right here the total interval of development of the Basal Quartz.

Q MR. GOODALL: About the Imperial Volmer, have you got the water table on that?

A Yes, sir. Volmer, we estimate the top of the quartz sand at minus 1341, which would be between the Qui Barre well and the Cardiff well and the top of the gas indicated a gas-water interface estimated at minus 1367, which compares with the Qui Barre minus 1339 as the top of the Basal Quartz and minus 1434 as the gas-water contact interface. You will note the position of those wells on page 14 of Exhibit 10, Census Division 14. The Imperial Volmer is close to Qui Barre well and we have a flattening in that general vicinity which extends the general accumulation down to the South and is approximately 4 miles south of Cardiff Giant. The top of the structure is undulating and the dip in the same general direction from north to south and the same approximate average dip.

Q How about Imperial Barre about 2 miles northwest of Morinville town?

A No, it is a mile and a half northwest of the town of Volmer. Southwest of the Imperial Volmer.

Q This is in Township 56, Range 25?

A Oh, that is the other Barre. It is the Qui Barre we are

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talking about.

Q But I say how about Imperial Barre? Is there any sand there?

A Yes, sir. The top of the Basal Quartz is minus 1330, which is 50 feet lower than the top of the Basal Quartz in the Cardiff Giant, which is on the other side of the Town of Morinville. Let me pull that log and see what the thickness of the Basal Quartz is. The thickness of the Basal Quartz in the Imperial Barre, which is in Township 56, Range 25, West 4th, Section 6, is from 3656 feet to 3860, plus or minus, slightly over 200 feet in a gross section. Our interpretation of the electrologs and drillstem tests were that that entire interval is gas saturated or water saturated. We have placed that as the eastern-western limits of the reservoir. A structural drop of 50 feet plus or minus from the top of the sand in the Cardiff Giant apparently is sufficient to pull the top of this sand below the gas-water interface due to the drape over the Morinville reef in an east-west direction. You see minus 1330 of gas-water contact in Cardiff and minus 1332 and then we have the top of the Basal Quartz in the Imperial Barre being at minus 1330. And the gas-water interface being in the east-west portion minus 1332, they coincide. There is no gas saturation at the top of Imperial Barre or at least so limited that it cannot be interpreted. There are no drillstem tests.

Q MR. GOODALL: The gas-water interface at Qui Barre is 1534?

A Now we are talking about Imperial Barre.

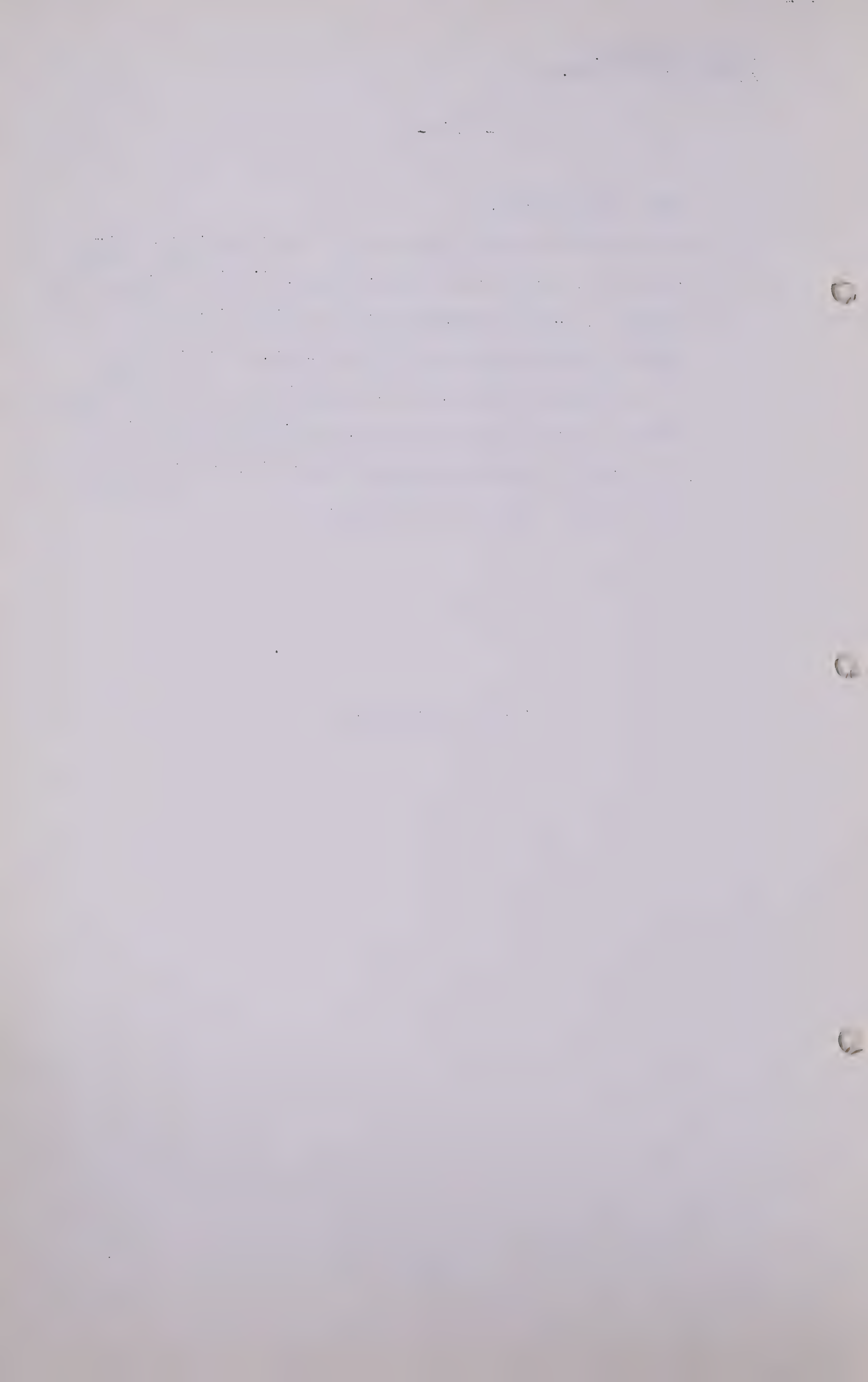
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Q . But I say Qui Barre?

A Yes, that is further down south. The gas-water interface is on a dip. Flat east and west, dipping north and south. A 50 foot drop from the Cardiff Giant to Imperial Barre which runs east and west, or northwest and southeast direction, and brings the top of the Basal Quartz at minus 1330 and a gas-water interface at minus 1332 is the interpretation we place on it, because there was no gas in the top of the sand.

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THE CHAIRMAN: Mr. Smith?

Q MR. C.E. SMITH: I hate to continue this, seeing that all of us down here understand everything that has been said, but to a layman, why doesn't the water up Waybrook way migrate down into this section down here?

A I don't know why stratigraphically perhaps, but they do. The unequilibrium does not seem to adjust itself from the time geologists are playing around with reservoirs.

Q You understand what I mean. It seems to me that water at Waybrook should come down and drown this out, if there is a continuous sand.

A The dips are very low actually. We are talking about -- let us take from Cardiff to Waybrook, we have minus 1253 and minus 1034, we have got 219 feet of dip across.

Q Quite a few miles, anyway?

A About 13 miles. So that the forces tending to move that water under gravitational forces are very small in view of the permeability of the sand, in all probability, just the general inertia.

Q It doesn't do what a poor layman would think it would do?

A Most do not, unfortunately.

Q I think enough of that. I see some counsel going out for a smoke, even now.

A I would like to join them.

Q Just another odd question, Mr. Dougherty. Having regard to this long discussion of water, having regard to what I might call the 1-well field where you have only one well to go by, what would you use in determining a table over your whole field, particularly after what we see

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here. Understand what I mean?

A Yes, sir. If we infer structure by reason of geophysics or some structural control, we attempted to project the gas-water interface horizontal within that structural limit until it intersects with what we estimate is the tip of the top of the producing horizon into that gas-water contact. Now, if we do not have information on that, in most cases there may be some exception, the attempt was made to conceive the gas-water contact as being at the base of the sand as penetrated in the individual well. That then would give crudely the limit of where we come out about on our proved and probable area. Say in a given sand, it drill stem tested 15 feet, no gas-water interface, projecting that out laterally on whatever structural control we have, would give us a limited area, but since the gas-water interface on the basis of that test may be assumed to be somewhat lower than that, our possible area then is our attempt to build it to what we think the lateral extent of the reservoir is.

Q Supposing you had just one well, I do not care whether you take Morinville No. 1, and no other wells to assist you with regard to gas-water interface, would we have this whole area at minus 1300? Is that what you have to accept, or what?

A With the control of one well we would have minus 1277 in that particular well as being the gas-water contact.

Q MR. PORTER: I think you are looking at Morinville No. 2 and Mr. Smith is talking about

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Morinville No. 1.

A That is correct, minus 1300. Then if we have no structural information at all and can infer none from making a reasonable map, then you just have to use your imagination.

Q MR. C.E. SMITH: Well, so much for that.

A What we tried to do in all these areas was to make a regional map very much like this map I was referring to on the Morinville area. We did the same thing in the Princess area and in the Leduc area. We did it over the areas covering census division 10, 13 and 14 up into 17. Where we had one well pools compared the original structure to determine if possible where the little nosing and flattenings were, the structural nosings or structural flattenings, either by seismic control or core control, and located those anomalies. That gave us the basis for limiting our total possible area then based upon the sand. The gas-water interface, its presence or absence in the sand by electrical logs or drill stem tests, we could then limit our proved and probable. It is all subject to judgment and interpretation where the control is limited. That is the basic idea as we tried to employ it.

Q MR. GOODALL: You assumed uniform water tables you had evidence there is, is that right?

A I don't quite follow that.

Q Where you have a structure, evidence of a structure for seismic work or some other information, and you have one well drilled which showed a gas-water contact,

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do you assume the closure control by that uniform gas-water contact?

A Yes, sir, if the area is small, if the structural feature is small. Most tilted water areas occur in very large features. It is very rare that in a small structure you have any appreciable variation in the gas-water interface. The larger the structure the more chances there are for the accumulation to be limited on the basis of permeability variations and the availability of total gas saturation in the drainage area of that particular feature. That assumption of yours would be correct on the small structures, we assume the gas-water table to be essentially uniform.

Q MR. C.E. SMITH: Would you care to give us an idea of what you refer to as a small structure in area?

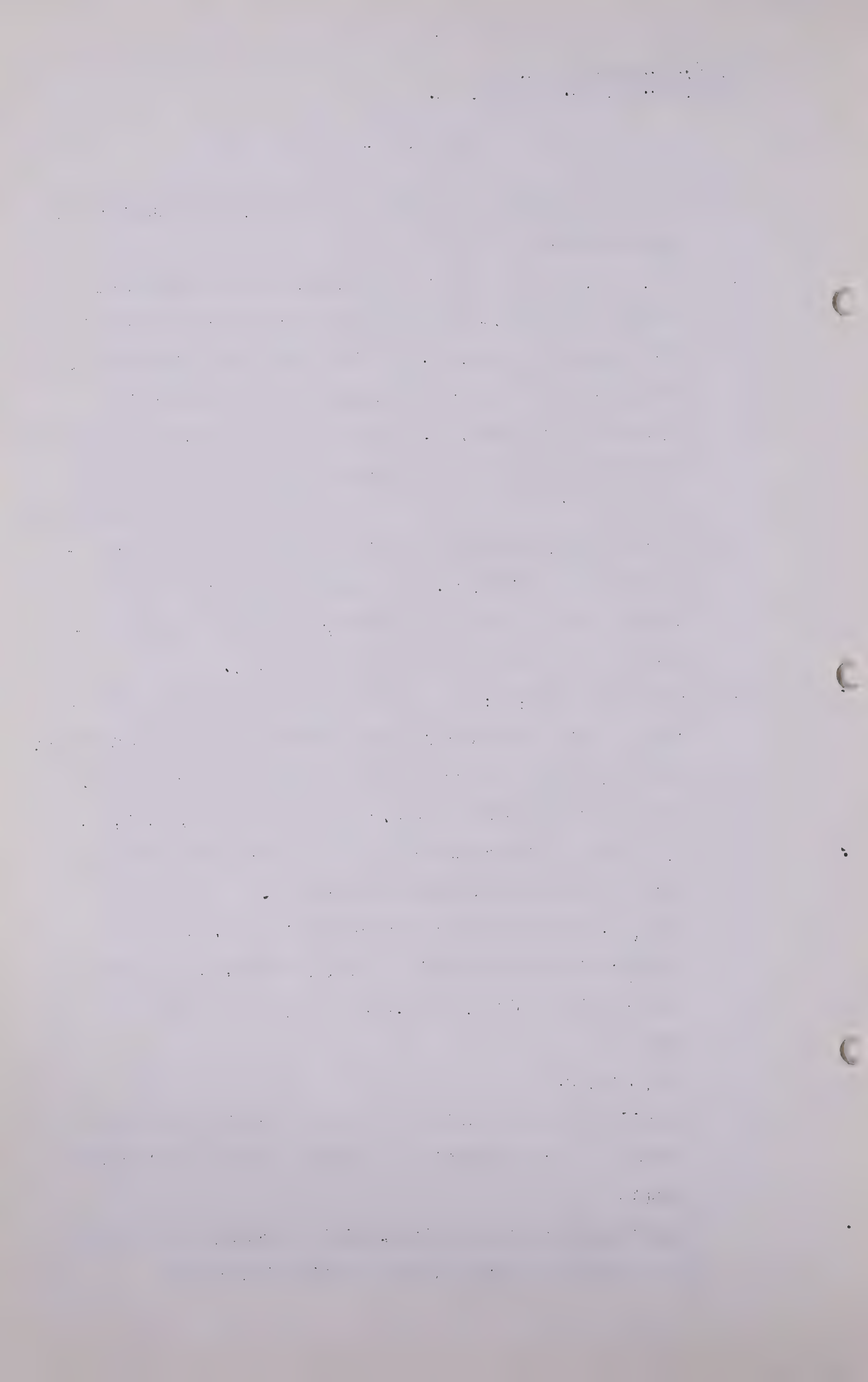
A Something less than the size of Morinville or Viking would be a small structure. Most of those 1, 2, 3, 4, 5-well fields where they are in close proximity we consider as being small structures.

Q Well, I believe we are through with water. Too bad we don't have something with it, I think. Would you look at the Provost field, census 7, and the map on page 9?

A Yes, sir.

Q And what we are interested in is the control you had in drawing or delineating your isopach on this particular map?

A That control was limited, limited really to the control of the wells drilled at that time indicating an



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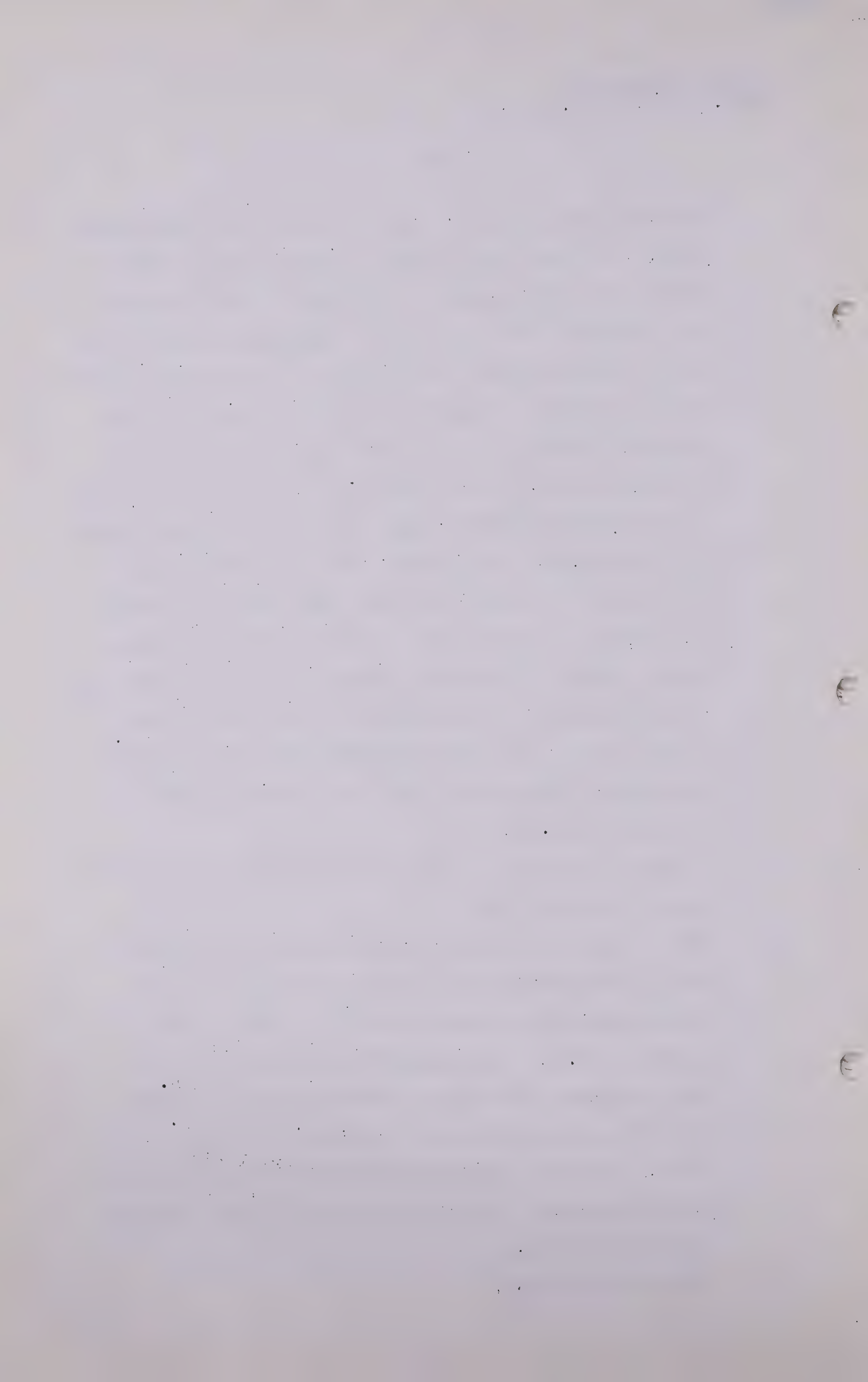
elongate accumulation of gas. We had no seismic information. You could make a crude structural map on the basis of the well datums. The limits of the possible were based upon the occurrence of gas saturation in very small amounts in what we consider to be the edge wells, in places where the edge wells were not drilled. For example, referring to page 8 in census division 7 in Township 38, Range 4, we have the No. 8 well with 1 foot of sand and small gas volume. That is in the north half of that township. We had well No. 5 in Township 38, Range 3, but we did not have any edge wells in Township 38, Range 2, so we pulled our limits within the trend control shown on the other township because of that lack of information in an attempt not to get beyond what appears to be a reasonable extrapolation of that control. The Provost area does not have good control. This is our best estimate.

Q I suppose that is an illustration of probably the poorest control you have had?

A This is one of the poorer ones, although the lateral extent of the saturation is quite large and whatever the configuration ultimately is it is going to be a sizeable volume. The ultimate field limits will be quite irregular as compared with the lines as drawn.

Q Excuse me just one minute, will you, Mr. Dougherty. Did Mr. Steer deal particularly with Imperial Kinsella No. 18 yesterday? It should be down in that southwest corner of the field.

A I do not believe so.



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Q I am sorry to come back to Kinsella again but there is one question I would like to ask you about that particular well.

A That is below Jarrow.

Q Yes. To come directly to the point without fiddling around, I have a note here to the effect that that is what we all might agree on as being a real dud, that well. Will you check your data. My note may be entirely out.

A We have whiskers on the well to indicate it has some gas. That is when we put the little gas well symbols on the top at the well symbol. Somebody interpreted some gas in there.

Q Can you check your data and see what you have got to show?

A Yes, sir.

Q MR. STEER: What is the location of the well?

A The location of the well is Section 27, Township 45, Range 10, West of 4.

Q MR. C.E. SMITH: That is the one. What I have in mind, Mr. Dougherty, is that it is possible the tests show what I call a real dud although the electrolog may show some sand with respect to thickness. I wanted you to comment on that, whether that be so.

A I do not have the interval of the drill stem tests in our records. We have the notation, "No gas on D.S.T." The electrolog would indicate to us, however, a number of feet of gas sand. Now, under what circumstances the tests are I do not know.

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Q The information I got may have come from the same place.

A That is true.

Q The point I have is, if there be no gas there I was just wondering why that is so well inside our proved area?

A Because we have good wells all around it, also with gas, and it will be a function of how that well was completed. That was a deeper test down in the Lower Cretaceous, as I understand it. I do not have the drill stem test intervals.

Q You have not a test there, I mean, presently with you?

A That is right.

Q That has no indication of a show at all, is that right?

A That is right. The electrical log, however, looks as if there is gas saturation.

Q We are just left where I started . at the moment?

A Yes, sir, quite right.

Q I think I have a few other details, but I am going to omit them for one more question. That is this, drawing your attention to Scovil Lake No. 1.

A Yes, sir.

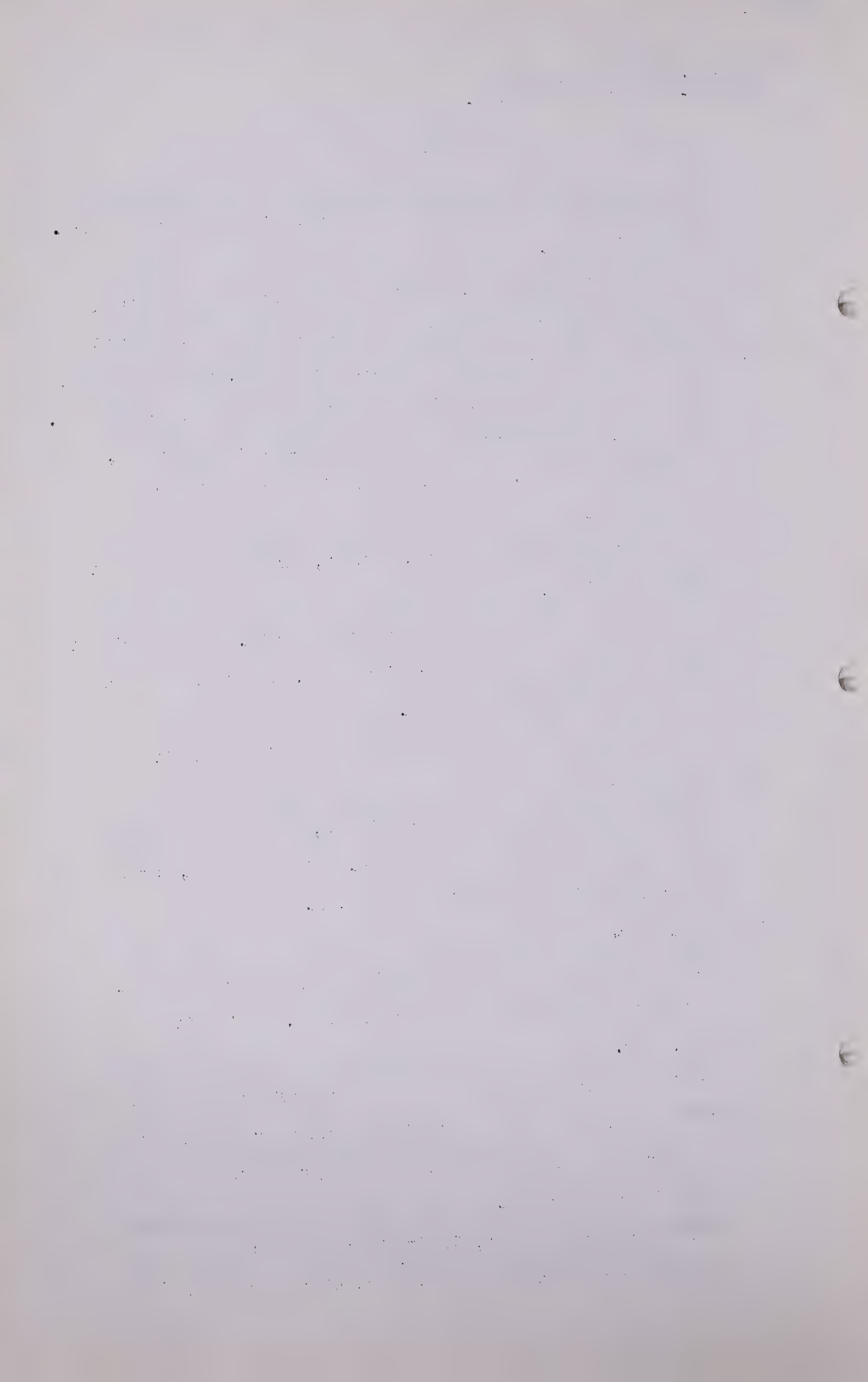
Q That is on the southeastern side of your proven area. I think on one map it is marked tight, isn't it?

A Yes, sir.

Q Having regard to what was discovered after you studied that well, you remember that you had to retard your eastern line in that area, of your proven area?

A That is quite right.

Q Having regard to that, is it fair to say there should be some considerable discount insofar as anybody is



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asked to consider this in dealing with the marginal area as is shown in Viking-Kinsella or in maybe any other field?

A The yellow area, the possible area?

Q No, the green area. We took off some from the green area after we got this Scovil well.

A Yes. We pulled that in to that point but there is gas saturation.

Q You will tell me it may be increased later if the other well was drilled?

A The limit was based on that 2 to 3 foot thickness. We did not say there is no gas there.

Q What I mean is, the line has been drawn in to what it used to be before you had the data on Scovil?

A Yes, and every time a well is drilled the line will become more irregular.

Q May go out?

A It may go out or it may go in.

Q Generally speaking, don't you think in the position, say, of this Board, that they might have to consider carefully whether or not they should even accept your figures or not, there should be a general discount considering marginal areas?

A I do not think so, because as I went through in detail with Mr. Steer --

Q I do not want to repeat that.

A Just one mention of it. Outside that limit there are large areas of well-demonstrated gas saturation. You might say discount it, but you are not going to be

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dealing with the reservoir.

Q To be on the conservative side with respect to the obligation this Board has, it would be more conservative to discount than to enlarge?

A Yes, one can be quite as improvident being conservative as being optimistic.

Q You want me to leave it in the position of saying, yes, you might be right but it might go the other way?

A We know there is gas saturation outside of these limits, and we essentially are dealing with the reservoir over a long period of time, not today or tomorrow.

Q Just one more. Having reference to Medicine Hat, for instance, and the same question with regard to what is called probable area, could there be a discount with respect to it if you were sitting as this Board?

A No, sir. I think the development within the last six months by Deep Rock and Britalta are removing much of the doubt one might want to place on that accumulation.

Q By the way, have you received something which was just distributed this morning, at least, I got it last night, from the Britalta Deep Rock people?

A Yes, sir.

Q Have you had an opportunity of studying that? I am not going to question you on it.

A I have read it, yes, sir.

Q Does it change your opinion in any way after studying that, with regard to what you had before?

A No. We are in the happy position of being in the middle in this case with estimates above and below it.

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Q Probably you would not be disappointed with it?

A No.

Q I think that is all I am going to bother you with.

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THE CHAIRMAN:

Anyone else any questions?

EXAMINATION BY DR. GOVIER:

Q Mr.Dougherty, I would like to go into the question of pressure decline in the Viking-Kinsella Field with you, but, first, following up what Mr. Smith has been asking about, and also following upon some of Mr.Steer's questions the other day, I would like to ask you a little more in connection with this proven, probable and possible?

A Yes, sir.

Q In Volume 5, at page 365, in answer to Mr.Steer....

A I do not have a copy of that.

Q I will wait a moment until you can get a copy of it.

mr. PORTER: I do not have one.

THE CHAIRMAN: Have you got one, Volume 5, Mr. Smith?

MR. C. E. SMITH: I have only one. We do not carry trunks with us into here, we try to carry all we can in bags. If Mr. Porter has one, he might give the witness a copy.

MR. PORTER: I have not one here.

MR.BREDIN: I have one you may have.

MR. PORTER: Thank you.

A What page is that, sir?

Q DR. GOVIER: Page 365.

A Yes, sir.

Q Towards the bottom of the page Mr. Steer asked you,

"I think you told me a moment ago" -
no, Mr.Steer's question was,-

"And then you have got an area which you classify

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"as probable where you say with more control, more or less additional evidence, you will move it up from probable to proven".

And you agreed with Mr.Steer on that, and then in your elaboration, you said on page 366, the record says there,-

"They are all relations",-

but I believe, Mr.Dougherty, that your answer was,

"There are all gradations".

A Well, it is "gradations" or "relative". I suspect it is "gradations".

Q "There are all gradations"?

A I think that is right.

Q And then you were asked by Mr. Steer, "There is the lowest grade, which is the bottom of the possible, and there is the highest grade, which is the top of the proved, and you have got shadings right down from the top to the bottom", and your answer was, "That is quite correct."

Following up on that, Mr. Dougherty, would you agree that at the top of the proven one might categorize your estimate as being 100% known, or known with 100% certainty?

A I am afraid there is no estimate of oil and gas known 100%. The best we can do with all the information, until the well is abandoned, no one ever predicts within 10% of what is going to be produced.

Q Would you agree with this, Mr.Dougherty, as you approach the top of the proven category, you approach a degree of certainty which is proved?

A We hope so, yes, sir.

Q And in the result that might be categorized as 100%?

A Yes, sir.

Q Would you also agree, in view of your answer to Mr.Steer,

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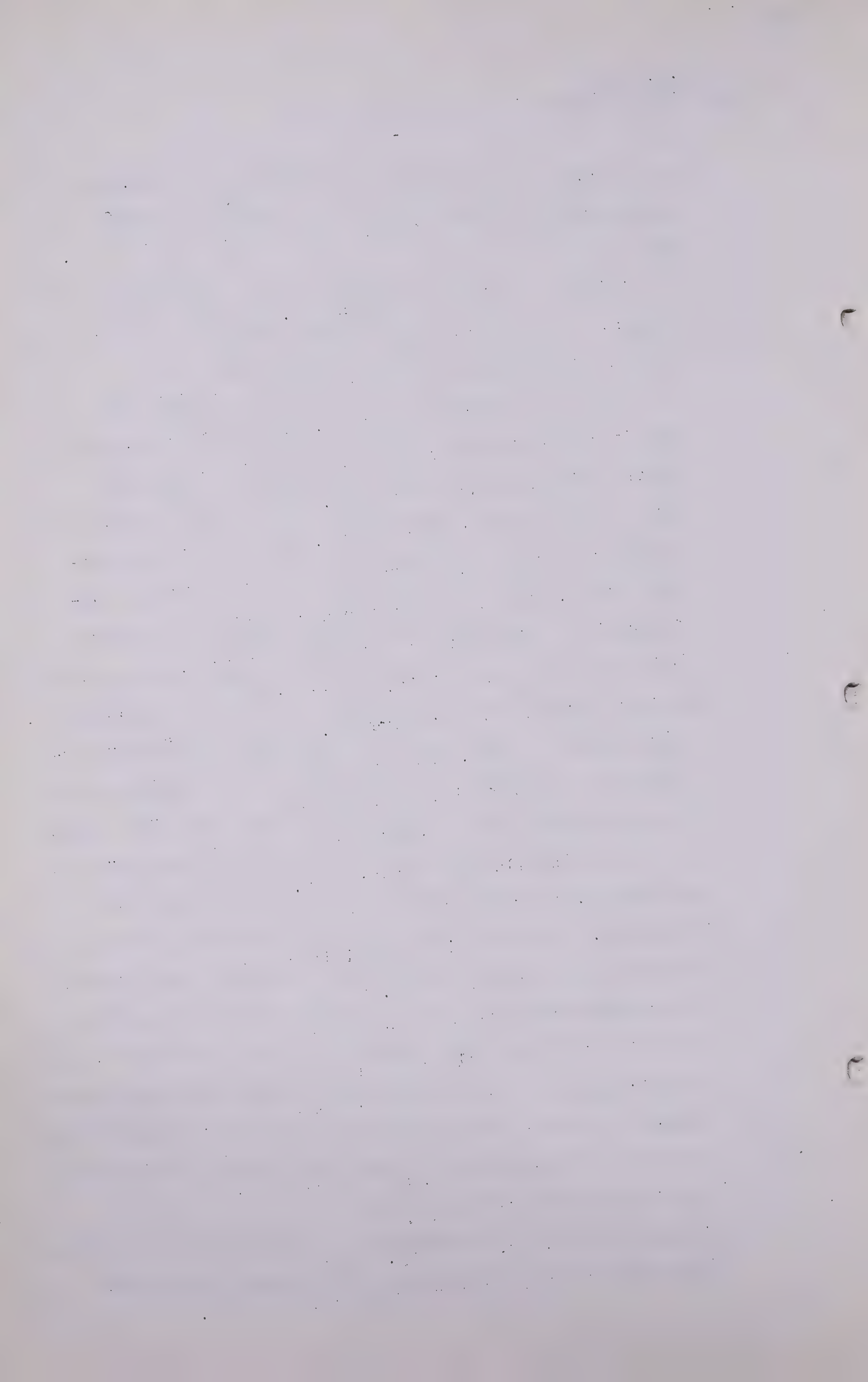
Steer, that as you approach the bottom of the possible you approach a category where the certainty is zero, 0%?

A I think that would be reasonable. That would vary even then. I do not like those degrees actually.

Q I know it is difficult to put a number on it?

A Because that is not always true. In other words, the limit of possible might be quite precise based on any well having a small saturation, and a very thin sand and we could draw it quite true, but that would be approaching a very high degree of certainty for the possible area, even though in another portion of that same reservoir we might not have the same control, but would infer that to be the limit. We have attempted in all cases, in treating all three categories, to have the full reservoir concept in mind, and not to attempt arbitrarily to reduce it or expand it. And I think that is particularly the major difference in opinion that may exist with regard to Viking-Kinsella and Medicine Hat. These reservoirs are so large, and the evidence of gas saturation is so widespread, that even with the limit of proved and probable which we have shown in Viking, the basis for which being a semi-arbitrary limit of 2 or 3 feet of gas saturation, that even with that ample control we feel that there is gas saturation in variably greater amounts well beyond those limits, so that I am now disturbed about the irregularities of that particular boundary, any more than any other statistical study with limited data.

Q I appreciate that, Mr.Dougherty. What I would like really to know is if we can interpret your answer to Mr.Steer



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along these general lines, that anybody limiting your proven category might be considered to include reserves that are 100% established or 100% known, and in limiting your possible category, it might be considered to include material where there was no gas at all included?

A In some cases that is true; in other cases, the possible might be fairly well defined.

Q Yes, I see, but taking, perhaps, the Provincial total on the statistical basis, and considering the limits, you would agree that there would be some of that zero gas included probably?

A Oh, yes. I think it is evident in the changes we have made in the course of time between the two studies. We hope the balance will work on the plus side, as have averaged so far, and there will be minuses and corrections within the individual fields.

Q So that when you say that there are all gradations, what you mean is that the degree of certainty with which these reserves are known varies from 100% in the one extreme to 0% in the other extreme?

A That is true. That is why we use the possible category, because essentially you cannot jump from proved, or you cannot bring in a well location from zero to proved logically, although there must have been a little evidence for its existence or it would not have been drilled as a step-out.

Q Yes, I quite agree with you. I recognize the pitfalls of argument by analogy, and I am sure you do, Mr.Dougherty, but would you indulge me in the discussion of an analogy to this situation and see if we can come to any conclusions?

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A Yes, sir.

Q Would you assume, Mr. Dougherty, that 300 men each owe you \$1.00?

A Yes, sir.

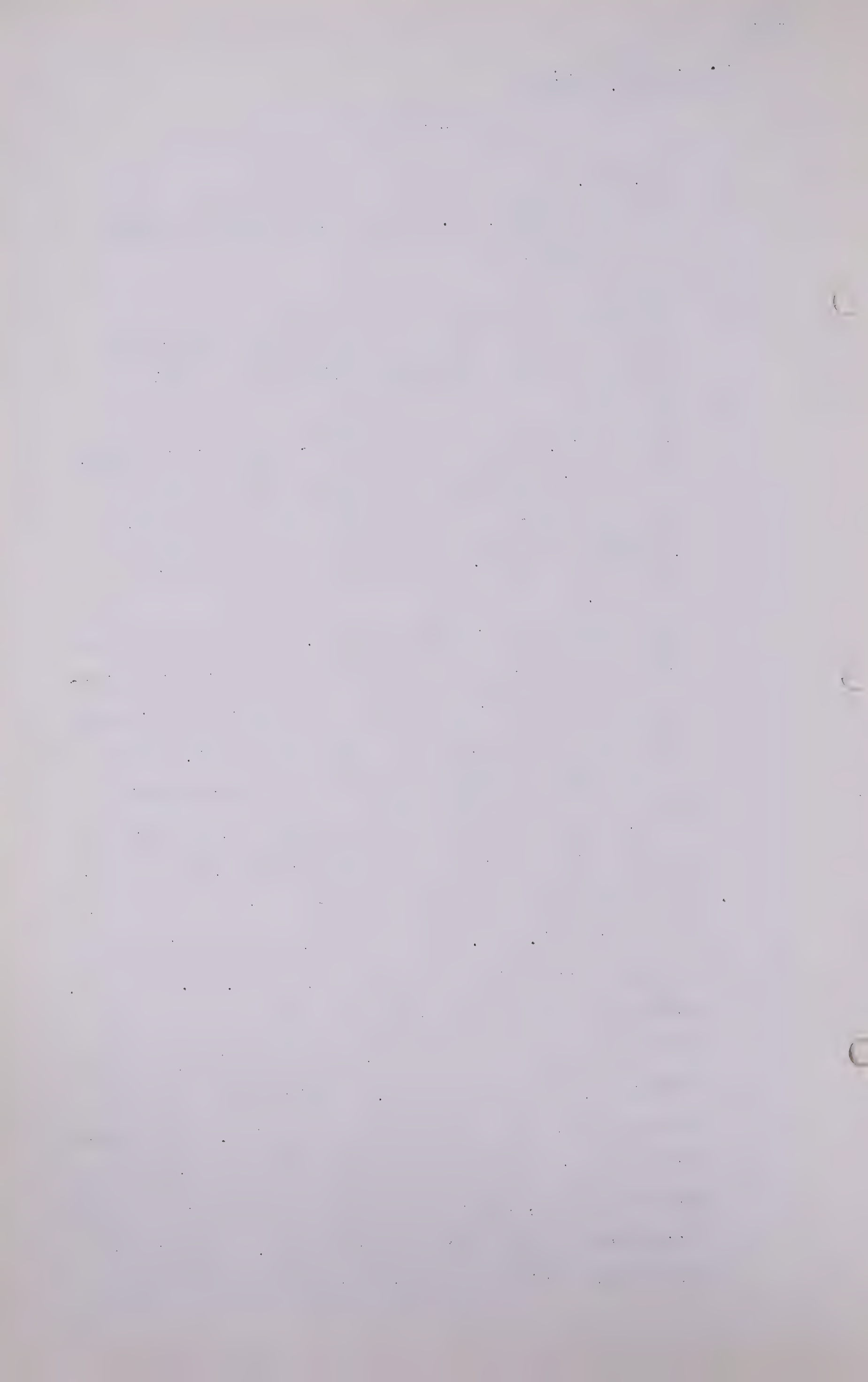
Q Would you also assume that within a prescribed time period you have a financial obligation to meet?

A Yes, sir.

Q And thirdly, that in attempting to assess your ability to meet this financial obligation that you engage a suitable expert to inquire into the chances of you regaining the \$300.00 that the 300 men owe you?

A Yes, sir.

Q And suppose this financial expert, of whatever type he would be, reports back to you that he has inquired into the financial ability of these 300 men with particular reference to their ability to pay you the \$1.00 that each of them owes you within the time that we are talking about, within the time of your obligation, and that as he sizes the situation up, there are all gradations from 100% certainty down to 0% certainty that these men will pay you the \$1.00 that they owe you in the period before you have your obligation to meet, I think, Mr. Dougherty, you would then be faced with the problem of having to assess the amount of money which you are likely to have coming to you from this \$300.00 obligation before the time that you have to meet your obligation. And I suppose that there are many ways that you could assess that. You could say "Well, regardless of the evidence of my expert that there are all degrees of certainty, I am going to assume that I will get all of that money from all of the



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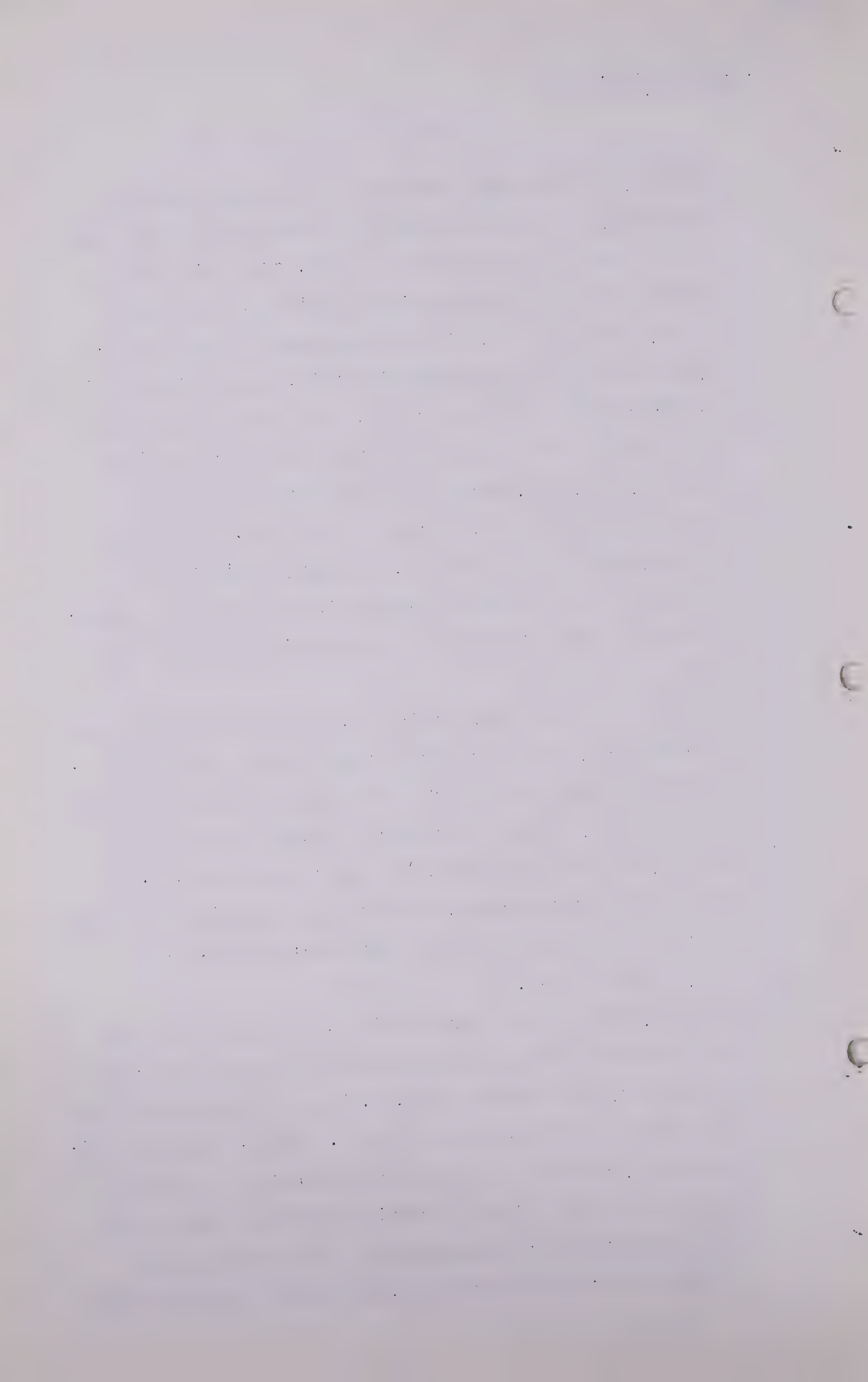
people", or you could take the other extreme and you might say, "I had better plan as though I would get none of the money from any of the people", or if you were trying to assess the most likely position, you would be in, would you not, with the evidence of your expert, argue along lines something like this, that if there were all gradations from 100% down to 0%, that perhaps you could say that 100 of the men in the top category range from 100% to, say, 67%, and would on the average be 83% likely to pay you off, so that of the \$100.00 that the top category of men owed you, I think you might infer that you had a reasonable expectation of obtaining \$83.00?

A You want an 83% discount on a probability basis for that unit?

Q Yes, that is what I am getting at. And to carry the thing further down, you might say that the second 100 men have, from the probabilities of what might be within the range of 67 to 33%, and you would only average 50% of probable payers, and from that group you might expect \$50.00, and from the remaining group, by that same reasoning, you might arrive at the answer that you would expect \$17.00?

A Yes, I follow that.

Q So that, adding up the expectations, you might arrive at the conclusion that you could reasonably count on 83, plus 50 plus 17, which equals \$150.00, in your hands by the time that you had the obligation to meet. Now, I realize, Mr. Dougherty, that this is not a true analogy to the case of gas, but I believe it has certain elements in common, and I also realize that I am assuming a linear probability distribution from 100% to zero, but I would think that you



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might, yourself, in interpreting the evidence of your witness, I mean of your expert, if he told you that there were all gradations, and he told you nothing else, I think you might say, "Well, I do not have to assume the linear distribution, having no further knowledge"?

A That is true.

Q Would you comment on that analogy, Mr. Dougherty, and its possible application to your three categories?

A Well, I see several fallacies, as you suggest all assumptions have. If you transfer this analogy to gas and close the door that there is no outside income, as you have closed the door on your \$300.00 from 300 men, that you had no other source of income to make up the deficiency of, say, your poorest expectancy payment from your, say, one-third of the total group, I can follow that. I think that is entirely false but I can follow that basis. The other difficulty, as I see it, is that we have demonstrated, I think, sir, something better than the linear probability which you wish to assume. I would like to rest or stand on our definitions and our distinctions on proved, probable and possible on the basis of the successful performance, let us say, in the interim between April 15th and August 15th. I have forgotten the summary I gave at the start of the Hearing, but for fields which we have revisions, the greater majority of them were upward rather than downward. I think there were 5 downward and 15 upward. I would then, in applying your analogy, consider the likelihood that there is a gauge of what that gradational probability curve is going to look like, given the same foresight and even luck, if you will, on the

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estimating. So that instead of the probability distribution of your three classes, we have got something quite different. I do not know how to apply it. In other words, a very considerable portion of the probable we have set up by later drilling was under-rated.

Q MR.C. E. SMITH: He has got two-bits on account from the second category, that is apparent.

A It was under-rated actually. It is conceivable to me that on a portion of our work instead of having .83 we should have 1.25 as a factor. We have some elements of conservatism by reasonable geological engineering technique.

Q DR. GOVIER: Yes, I think that is a very good point, Mr.Dougherty.

A I do not like discounts to be always on the negative side. There should be a proposition and then elements which might tend to indicate that you have under-rated, and there are a number of pluses, they are not all minuses, and I would indicate the four down and the fifteen up, realizing that that performance was, maybe, fortuitous, but at any rate, it was not distinctly the other way. I would say that would be my reaction to your proposition.

Q Perhaps we could pursue it a little further after adjournment?

A Yes, sir.

THE CHAIRMAN: We will adjourn until 1.30.

(Hearing adjourned until 1.30 p.m. September 20th, 1951).

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MR. C. E. SMITH: I wonder before you proceed, I mentioned Mr. Dougherty's submission from Britalta. Probably they should be recorded as interested parties. I think some of them are here. Mr. Cloakey, I think, is here.

Q DR. GOVIER: I wonder if first we could get an answer from you on how you would assess your own ability to meet some hypothetical financial obligation within a stated period of time on the assumption that you had a report from an expert along the lines we discussed before adjournment. Let us confine it to the dollar problem and not think about gas for a moment or two, if you do not mind.

A During lunch it occurred to me that perhaps the question of the accuracy with which the books were kept is a big point, and the matter of this man who thinks he is owed \$300.00 by 300 men may not have got to the credit side of the books and there are a number of these men who owe him \$5.00.

Q Of course that would be a different problem. Let us assume the problem where there are 300 men who owed him \$1.00 and we can discuss the other later?

A I would say experience to date might demonstrate that the books were not too clear and that some of those men did owe you \$5.00 and being essentially honest paid you off 3 instead of the 1.

Q Surely the problem I suggest is a possible one, is it not?

A Yes, sir. If it deviates far enough on its assumptions from

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the problem at hand it is difficult for me . . .

Q Let us consider both of them, the one I posed first and the one you suggest secondly.

A Because essentially another factor comes in that in this probability we have been talking about of your three characters of men paying off the assumption is that the men whose integrity are the highest are assessed at 100%.

Q Let us say integrity plus financial ability?

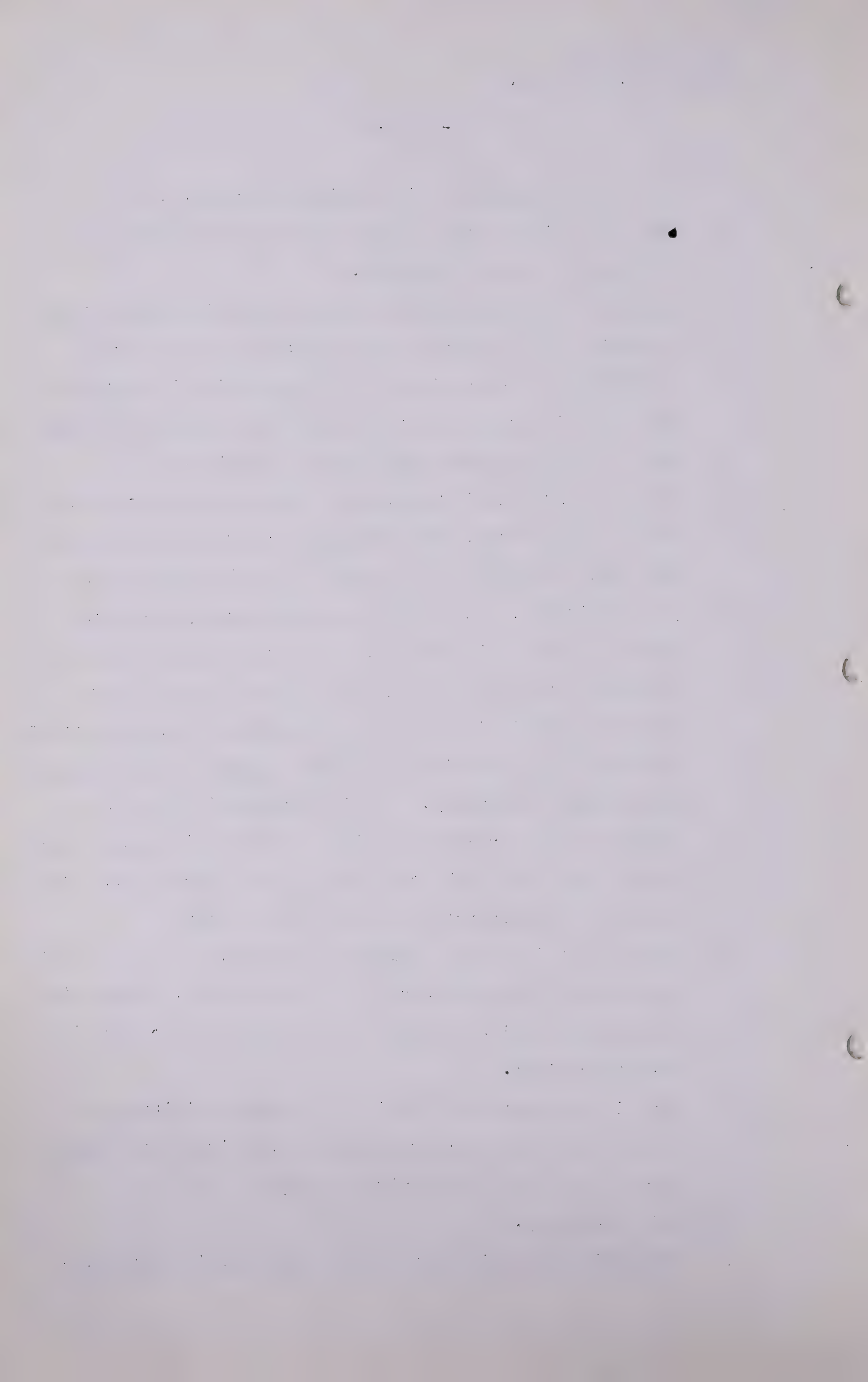
A But actually that is true, say, for those whom you consider to be proved, good borrowers who will pay you back. But when you come to the second classification of men your estimator, your expert, may have already taken into account another discount that he is not too sure in his own mind that they can pay off, but he does not know actually what is in their bank account, so that you cannot start on the assumption that that category of the probable is assessed accurately. It is already discounted, the estimator has already taken into consideration some doubt in his mind due to the circumstances in which he was able to assess the financial stability of the men.

Q Surely that is a mere reflection, though, that the expert has advised you that there are all gradations, probability of payment ranging from 100 in the one limit to zero in the other limit.

A That is true although within the probable limitations there might be no zero gradation. You might never reach zero. Its bottom level might be 50%.

Q Quite possibly.

A And having that discount in mind the normal probability



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of distribution would not function. You would have in addition the fact that, let us use our experience as to the probable which has become proved. It was proved at that time physically but not in the mind of the estimator that you could not discount. There actually might be a factor of 1.1 or 1.2 that should be applied to the probable in discounting. It is always discounted in the mind of the estimator, so that you doubly discount on the probable.

Q I do not see that point, Mr. Dougherty, with reference to the particular problem which I initially posed, namely 300 men each with a dollar debt and an examination on the part of an expert of the probability of each of those 300 men being able to discharge or pay their debt within a stated period. If that is the problem we are considering then the question of double discount does not arise, does it?

A Yes, because in your second category of men, in your middle 100, your information is uncertain and the set-up is not as good as in the first 100, those who have proved financial stability. Now your second group you have already discounted in the mind of the estimator, due to evidence which is not too good and then actually you are starting not with an accuracy of 100% but with 80%. If you discount that a second time, in view of the performance, let us say, of that group in a limited period of time, wherein a high percentage of that group pay off, you still apply the discount on the estimator's discount. Then that is a double penalty. If you wish to go back to the record of their pay-off and re-examine it and see that whereas

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four have failed to pay 15 have paid up over and beyond your expectations. Then you want to re-examine even your estimator's discount.

Q I see that you are referring to a re-examination, Mr. Dougherty. You are suggesting that you, as the person to whom the money is owed, would disregard part of your expert's advice to you and would you say "Well, I am going to re-examine these books myself"? Surely there should be some way for you to take your expert's advice and to interpret it in terms of the amount of money which you could reasonably count upon having to meet your own obligation?

A That is true.

Q Or possibly another way of putting it, you could take your expert's report and take it to your banker and say, "Here is my picture, will you assess the reasonable ability of paying my obligation."

A I think the banker would have the advantage of additional knowledge which would tend to show that the estimates made by your first expert in your second category, the amount is too pessimistic, it already has a discount over and beyond the real situation.

Q Surely if that expert were an experienced man while he might be too pessimistic in some cases he would be too optimistic in others and it would balance up much as you have estimated your discounts might?

A That is true. I think one would want to look at the record and see how the deductions compare with the

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additions and weigh them, not perhaps too strictly, but weigh them in considering what the middle category means, what "probable" means.

Q And I can see, Mr. Dougherty, we have to make a further assumption before we can arrive at a numerical answer?

A That is right.

Q Assuming that you had no other knowledge beyond the report of your expert, which is to the effect that there are all gradations in the ability to pay from 100% at the one end to zero % at the other end, on the basis of that knowledge and no other concerning the ability of these men to pay, would you estimate for me the amount of money you could reasonably count upon having to meet your obligation?

A If we want to take our proved category of debtor you might assess that at 100%.

Q For all the men in that category?

A Yes.

Q For all the hundred men?

A Yes, sir.

Q I see.

A Because you have already eliminated from that classification all with any reasonable doubt and placed them in the second category, probably good debtors. You have applied a discount already to arrive at the first group so as to make the segregation of the "proved" numbers.

Q Go on?

A The second group you have a further kind of segregation and sub-divided. You actually have 200 remaining which you are looking at and you have to split those again. You

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put 100 of them in the second ranking category and 100 in a third ranking category. You have in effect discounted those debtors in the second group twice almost. You have removed them from the first category and separated them from the third category and if your information on that group is less than on the first group, which you have assigned as being proved, good debtors, you have a discount factor inherent in that judgment. Then if your experience over a period of time, by and large, your experience with that second group or category has demonstrated to you that they really belong primarily in the first . . .

Q We have not got any experience, Mr. Dougherty. We are going to accept the report of this expert. That is our assumption.

A We have some though actually, I think. I do not think we can close our minds to that. However, I can assume we are willing to close our minds to that. I do not think it is a valid assumption.

Q It might well be with respect to financial matters, which I myself could understand.

MR. C. E. SMITH: Which side are you on?

A I think if you may call those assumptions, with limitations, you are hedging it in very closely. Then your analysis would be invalid and not realistic since adopting the validity of these encircling assumptions they are circumscribing the situation too closely.

Q Some of them might well be, I recognize that. I thought it might be useful to get your opinion on that illustration and then we might progress later and see how it

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would be modified on the gas problem.

A I appreciate that very much.

Q Is it then your opinion on this hypothetical problem that you would estimate \$83.00 as the likely revenue from the first group of men, or is it 100 you would consider?

A I would assume 100. If your expert has whittled 300 down to 100 you have a high order of probability of expectation of payment. There the difficulty of the assumption is that I would always want to modify that by experience with that group again.

Q You might have no experience?

A That is true and if you have no experience then there is a discount I agree.

Q Of how much?

A I am sure it won't be a straight line between 100% and zero across the three categories. It has got to be a curve with a sharp drop-off in your last group of 100. So there should be a high order of accuracy in the second category, say 75% or 85%, because you have winnowed them twice actually. You have eliminated 200 out of the 300 and 100 out of the remaining 200 and the intermediate category is between something well known and something you have discounted heavily, so it should have a high order of accuracy.

Q And you would suggest 75 to . . .

A 75 to 85 per cent, following the assumption that you are not going to give any account to the experience in that category, limited as it may be. With that assumption.

Q And with the same assumption what is your thought in

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connection with the third category?

A I would say 50%, because actually you have started out perhaps with a far larger group than 300, checking your books.

Q No, we only had 300?

A And those 300 are actually the residue of a much larger figure?

Q No, we started with 300.

A Well you circumscribed the situation too closely, I think.

Q Mr. Dougherty, is your suggestion that 100% weight not only should be assigned to the first category but to all members in that category, is that consistent with the statement that there is a gradation in the degree of accuracy all the way from the top of the proven category to the bottom of the possible category of debtors?

A I do not think that is quite true because for the top category you have already eliminated the doubtful out of the 300 and you are getting down to 100. I do not think that follows. I am almost thinking more and more in following your viewpoint in this discussion that the gradation must be 100 to zero in the total of the three categories.

Q Yes, and how would you draw the curve?

A Fine on top with a sharp drop-off when we come into the lower portion of the probable and into the possible. First 100%, then 75 to 85% and a drop down to 50% down to zero.

Q Would that curve reflect a gradual gradation from one extreme to the other? I am not using the word "gradual" in the sense of uniform.

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A I would say gradual.

Q It would be something of that order?

A Yes, exactly, but now we have eliminated our, or we have discussed our 300 and in my thinking I would still superimpose on that another curve in which the portion over the proved, or the first 100, is essentially flat, paralleling your bottom axis but over the probable it is humped up. It goes above one.

Q Why?

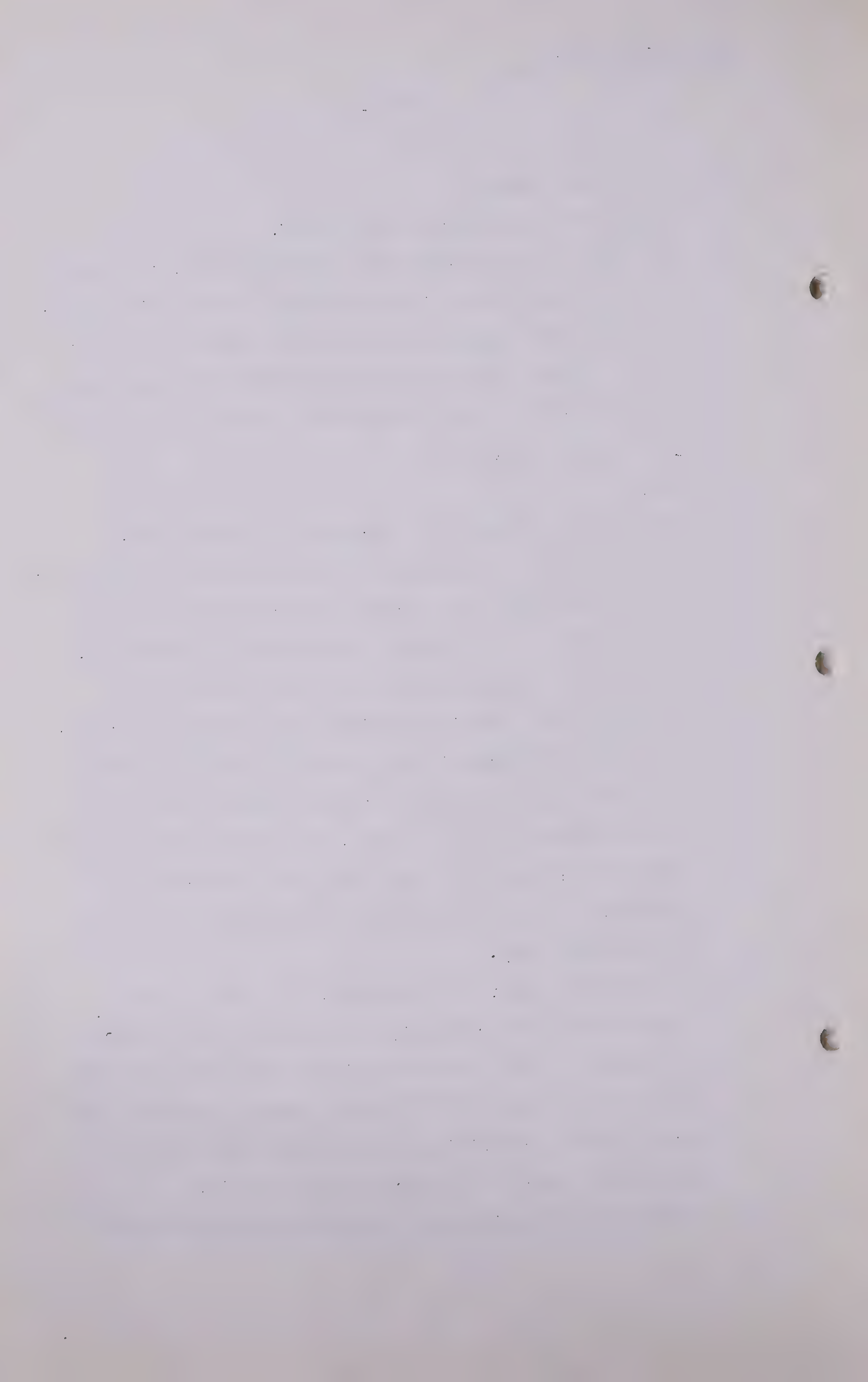
A Because the estimator has already discounted that.

Q But he has only discounted it surely because a study of the facts concerning these debtors indicate to him that the probability of their paying, regardless of the reason, is less than the figure which he would accept as the minimum to put them in the first category and he accordingly puts them over in the second or the third category.

A For someone else outside of himself but not for himself. To the observer on the outside, yes. But we feel that the difference between his 100 proved and the second 100 probably is a matter of opinion, the degree of it but not its actuality.

Q I appreciate that, Mr. Dougherty, but surely we are talking about the certainty with which we are to know the amount of money which we might expect from those men. It is that estimate of the expert which if properly done gives us the probability or the number that should be attached to each of the men, is that not it?

A That is true providing you know precisely the thinking of



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the estimator and find that he has not been over-conservative or over-optimistic in a given category and that can only be gained by experience. That is not an instantaneous reaction. It is one through time and that I think is a problem we face. That includes what you are going to bring back into the books. You cannot circumscribe it too closely or else it defeats the purpose you are after.

Q Could your views on the hypothetical case I put to you be summarized this way. You believe it would be proper in assessing your financial position to assign a weighted factor of 100% to the first 100 men and to the second 100 men you would assign the lesser weighted factor, you are not sure what it would be but you think perhaps 75 to 85 per cent?

A That is on the assumption you are not going to re-examine at a later date.

Q There may not be any other re-examination. You might be on your way to the banker and you might have to say, "Well, here is my position."

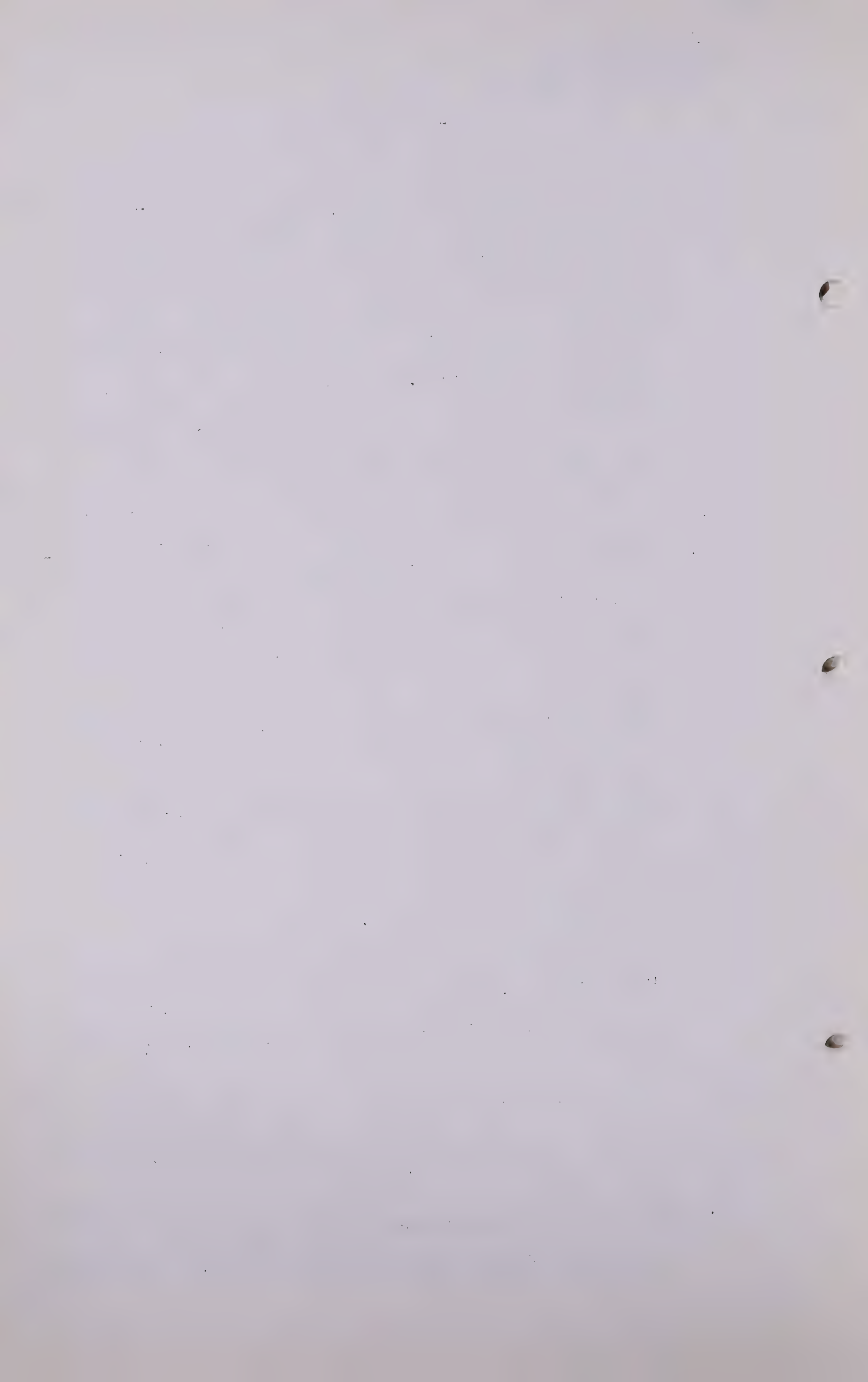
A That assumption is quite correct.

Q And the third category likewise, you would say the weighting factor should operate, but you have little way of saying exactly what it is. You would suggest 50 per cent?

A Yes.

Q Would you suggest that 50 per cent even if the last man in that 100 group has been assigned a value of zero by your expert?

A Yes, because the further you are away from the precise the more surprises you are going to have in dealing with



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the category you can least compute. Your evaluation of it can err on the low as well as the high.

Q But surely that would balance out on a statistical basis?

A We trust it will.

Q Would you like to discuss the problem you suggested where a man's books were not properly kept?

A I think that is inherent in the over-all picture.

Q Shall we progress to gas then, Mr. Dougherty?

A Yes, sir. That essentially in restricting the thinking to all the reserves to a given area or a given series of fields, prospects or discoveries you are restricting it unnaturally and ignoring the trend which brought about those discoveries, in the fact that you have that data. It had something behind it. It is not going to stop tomorrow and that is something we cannot evaluate. Mr. Trostel will have some remarks or some exhibits which will tend to amplify that that the trend of drilling and development which has brought us to this stage has shown acceleration and will continue. It is not a static affair and that is a little bit like the 300 men and the set of books you kept on it. Your statistics are not too kind on your debt. You might err seriously on the low side.

Q Or the other way?

A Or the other way. But you have discounted them heavily, however, already, by separating them into three categories and some of those men are going to pay you \$5.00 where you thought they were only going to pay off 1 or 2, as experience will show. So that discounting the ability of the estimator to make them, they assume the situation as

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static whereas it is really an active affair. It is going to work on beyond the amount you can see right now and the estimator cannot evaluate that but you must.

Q Suppose, Mr. Dougherty, that the Board wished to determine (a) the amount of gas presently known, that the Province can reasonably count upon and (b) future prospects. Now just let us talk about (a).

(Go to page 674.)



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Q On the basis of determining the amount of gas which was present?

A Make it a very static consideration.

Q And we will add a plus factor later for the other. On that basis you would not agree that to add proven reserves and probable reserves without discount is an inconsistent thing?

A On that first assumption. It is with that assumption. It would be inconsistent. I would put a time factor in, though, if you are only going to consider as an instance proven or probable reserves. That must be for only a limited viewpoint because the other categories have the progressive element in them inherently.

Q I take it what you are saying is that in looking at this overall problem one should take into account not only the reserves as can best be estimated today but also the trend?

A That is right.

Q But if we confine our discussion to reserves and decide we will talk about trends some other time, then would you agree that the Board in interpreting your data or your recommendations should say, we will take the proven category and the Board understands it is Mr. Dougherty's recommendation in the proven category that the weighting factor is one?

A Yes, sir.

Q And we would take the probable category, and would we be right in understanding your weighting factor of 75 and 85 would be proper?

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A Yes, for the static consideration.

Q Would you suggest we should also take the possible category and use a weighting factor on it?

A Yes, very much so.

Q And the weighting factor would be 50 per cent?

A Yes, sir, that is correct. I think with those assumptions I would not object to that at all.

Q One of the things that disturbs me, Mr. Dougherty, is that from the figure that you have selected, that is, 75 to 85 per cent and 50 per cent, it sounds as though you have evidence of background experience which enables you to say that the probability distribution is not lineal but it definitely humps up?

A Yes, sir, because of that little factor I mentioned before, that you can not go from proved to zero. If your viewpoint is circumscribed around a few wells in a reservoir without looking at the reservoir, looking at a few trees instead of the forest, it is going to be low, it is going to be wrong.

Q But do you not think, Mr. Dougherty, that there is almost an equal chance that the probability may range from 100 to zero by means of a line that is less than below a diagonal line as well as by a line that lies above a diagonal line, and that accordingly under the lack of a clear definition of the location of that line it would be most reasonable to assume it was in a good position?

A No, sir, because a selection has been made. If it were purely a random selection I would agree, but it is not,

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the selection has already occurred. You have already thrown out in effect things below zero.

Q Well, I should hope so.

A Below your possible. You have already thrown that out.

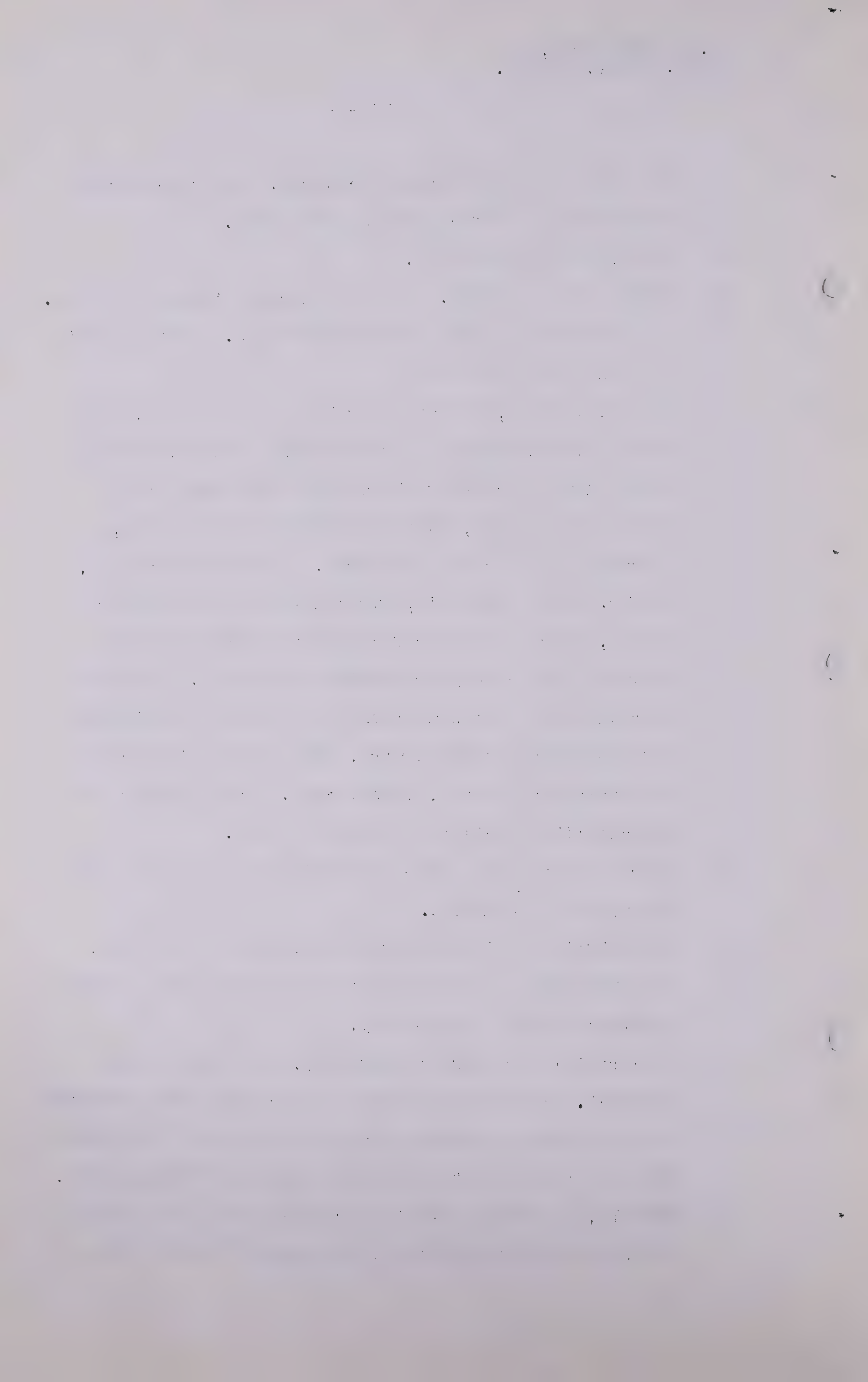
Q But you did not throw out the last one. There is still one in there with zero?

A There, I think, we have a problem of reference, that when you started out to work on this you eliminated a great deal of country which might have been in the possible category, just wiped that off the slate, perhaps 85 per cent of an area. If you look at our, as Mr. Porter calls it, our measled map with the red spots, there is a terrific amount of white area and that was basic in your original selection. You have already taken out what would be a random distribution of everything in the centre. You have a high order of something on the top, 10 per cent. That is where the probability function gets into trouble.

Q Surely that is the same as leaving out the people who do not owe you money?

A The difficulty is you have books, you are not sure, you have not kept a good set of books, and that is the difficulty with the analogy.

Q I certainly realize the analogy, it is by no means perfect. I have been unable to reconcile your statement of a continuous gradation between the top of the proved and the bottom of the possible with your further step, namely, the proven and the probable categories, and I might go one step further, the complete elimination of



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the possible. I do not understand that at all.

A Well, that is one of those discounts that have got to go in when you are considering the estimator, that there are discounts above and beyond which may be far more stringent than would appear at first glance, and that is the difficulty of arbitrary subdivisions, arbitrary differences. That is why I insist that really the application of a discount to the higher orders is a double discount, they have been discounted already.

Q By virtue of the fact that they have been included at face value. I do not understand your statement that they have been discounted already. You took a delineated area and you measured a number of square feet in it. You did not apply any numerical discount, Mr. Dougherty, in making the computation of probable reserves.

A In the probable, though, in many cases the experience during the last year on those has indicated we were too stringent in defining the proved line in our own minds. I think that is certainly true at Cessford, and at least fifteen other examples. We do not know yet about the others. That is the thing that I think we want to take into account in any revision, and which we hope the Board will take into account in considering what those things mean and how they are going to interpret it. That is why we added proven and probable in the first instance in comparing as we could the Board's estimates with our estimates. We decided that what we had set up in the two categories appeared to be the rough equivalent to what the

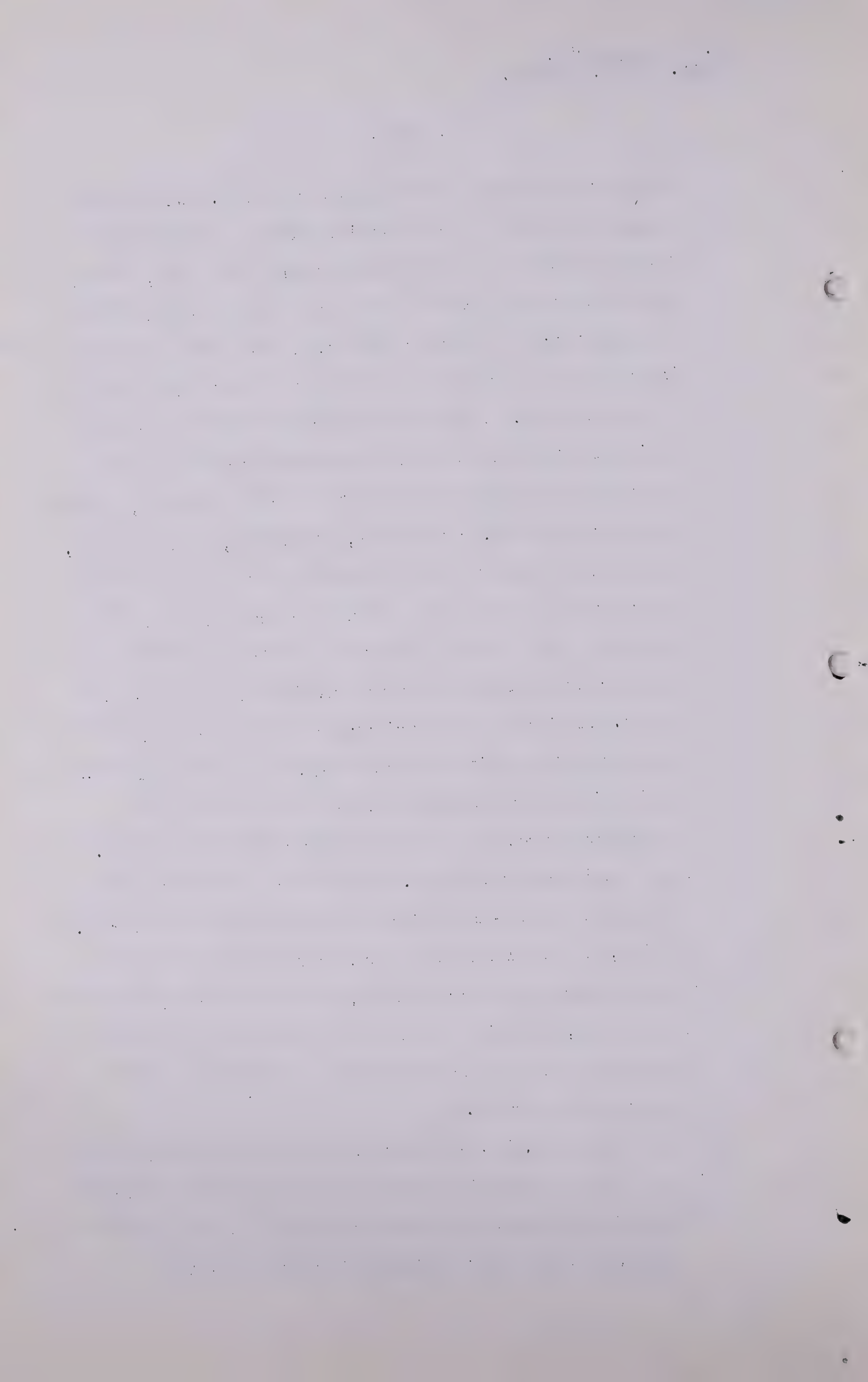
Figure 1

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Board had set up as established reserves. We may have erred in making the subdivision but it is one that we wanted to make on the informational basis only, not by any great doubt that there is any lack of validity to the existence of those reserves, and I think the experience in the last six months has borne us out fairly well on that situation. When you take the subdivision down to available for sale and put discounts further beyond reserves involving what is left in the reservoir, assume fuel for drilling, compressor, shrinkage, field losses, and applying that to the possible, we feel that that was carrying the total discount factor so far that we would be just as well ahead to leave the possible out of any consideration so far as availability was concerned, and that is the primary reason for putting the possible off into its own category, is that the availability in effect should deal only with what is essentially proved developed and proved undeveloped. As I mentioned previously, we might conceive of the probable as a sub-classification of proved undeveloped. I think, as our work has shown, that that appears to be a high order of probability, on what we really mean by probable, that it is a lower category of proved undeveloped and as such should be included in the availability studies.

Q In summary then, Mr. Dougherty, would you say that if the Board wanted a static picture we might take your proven figures plus some proportion of your probable figures, plus some proportion of the possible?



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A Not for the availability but for the total reserves in the Province, yes.

Q But as far as gas to meet our obligations within the next specific period, you would exclude any portion of the possible, would you?

A I would think so. I would make the period limited, though, very limited, because that is the difficulty with the static assumption.

Q Either that or you would add to that conclusion, the conclusion you could arrive at by consideration of trend?

A Yes, sir. I think that is probably the most reasonable approach, realistic, proved 100 per cent, probably at a discount that they have re-evaluated on the basis of trend or projected on the basis of trend.

Q There is a related matter, Mr. Dougherty, that I would like to discuss with you. Do you still have volume 5 there?

A No, sir. We borrowed that some place.

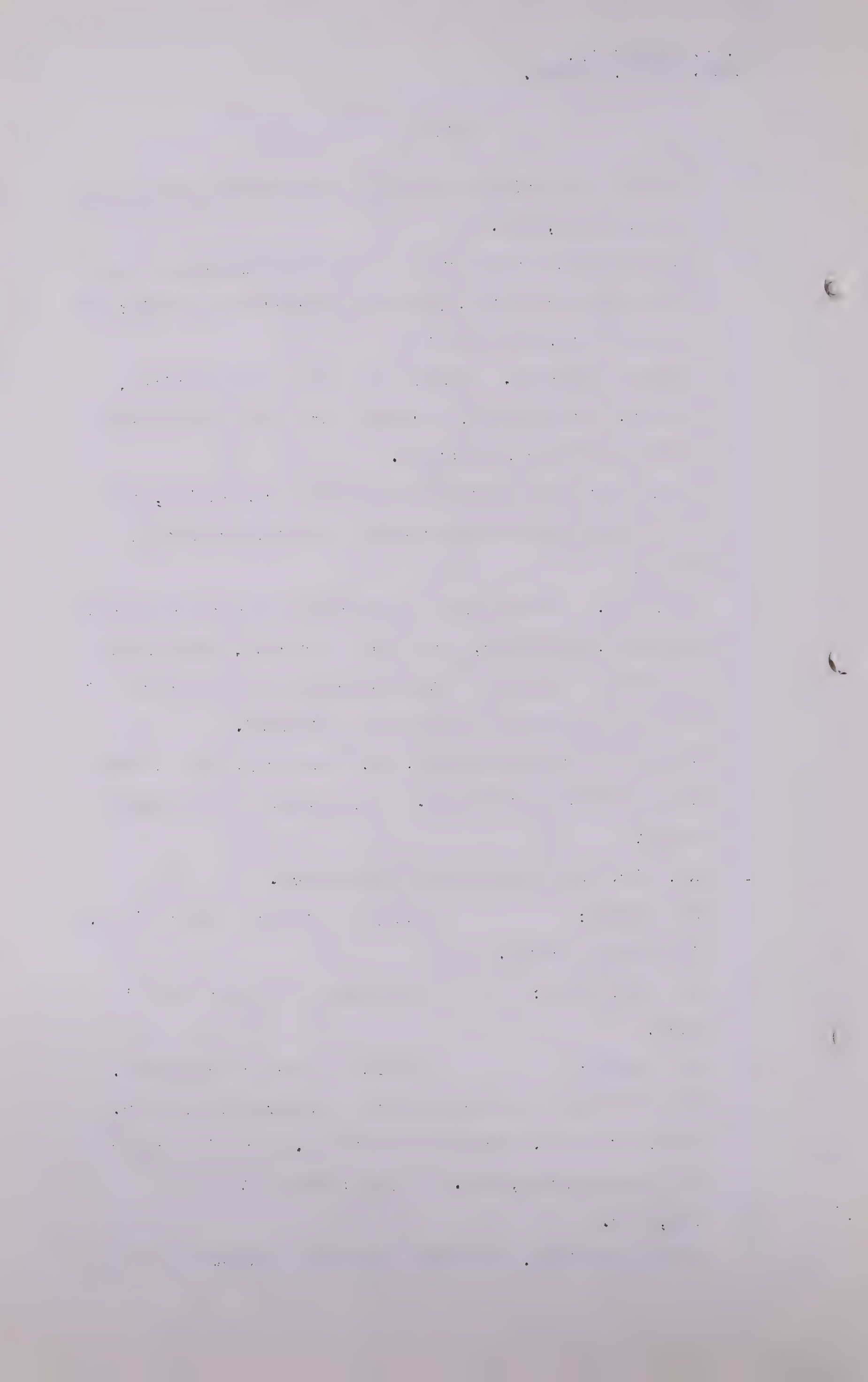
MR. PORTER: We paid it back very rapidly,
it must be proven.

MR. C.E. SMITH: The City of Calgary got it
back.

Q DR. GOVIER: Would you look at page 406.
This is where you went into the explanation with Mr. Steer of the 8.4 trillion and the 4.4 trillion reserves for Trans-Canada, etc. Do you recall it?

A Yes, sir.

Q Going over this, it seems to me that you must be inter-



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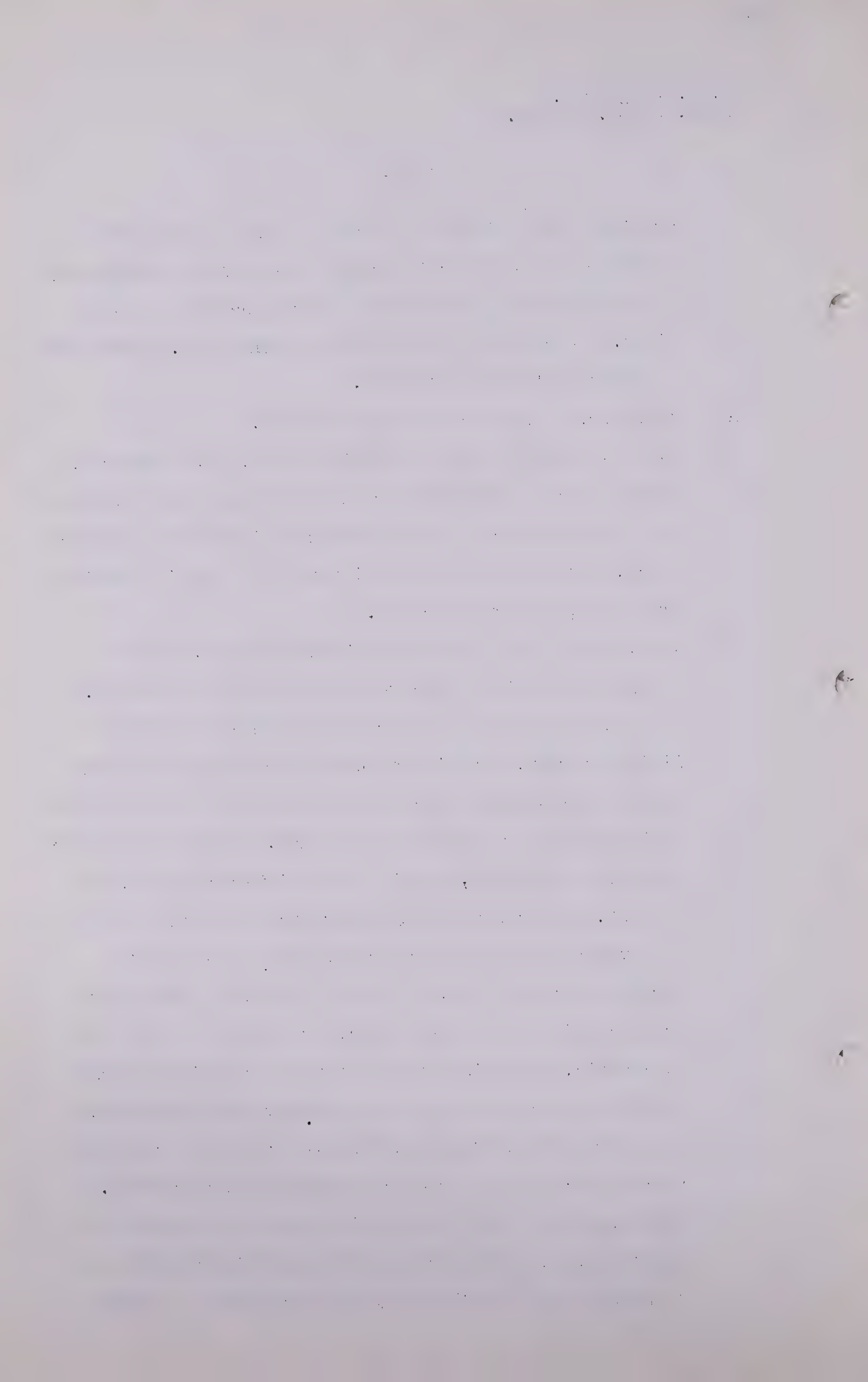
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preting your available for sale of gas as gas which over the next 30 years' period is available economically to meet Alberta and possibly export markets, is that right? Because I note you have taken the 8.4 and made a direct subtraction from it.

A Yes, sir, I think that would be valid.

Q But I understood you previously to say, Mr. Dougherty, that your gas available for sale had not been discounted for those portions of it that might lie beyond economic reach, either by virtue of distance or highly expensive processing or other factors.

A Well, that goes back to the situation we run into every time on the static versus the active viewpoint. If we are going to consider the economic as today of limited market, that is an entirely different problem from the situation in active development over a 30-year period with increasing market demand. Then the economic picture is changing, and it was my interpretation, my thought, that certainly my experience with gas fields in development that we underestimate the needs of markets on this trend. I know of so many examples of areas considered as uneconomic, or wells or fields as uneconomic, which in a two to five year period became quite economic just due to a slight market expansion, and the areas and fields which suffered most are those which are close to large accumulations with markets. The point in mind I have particularly is the Hugoton gas field. It was overshadowed by the Panhandle gas field for at least fifteen years because of higher



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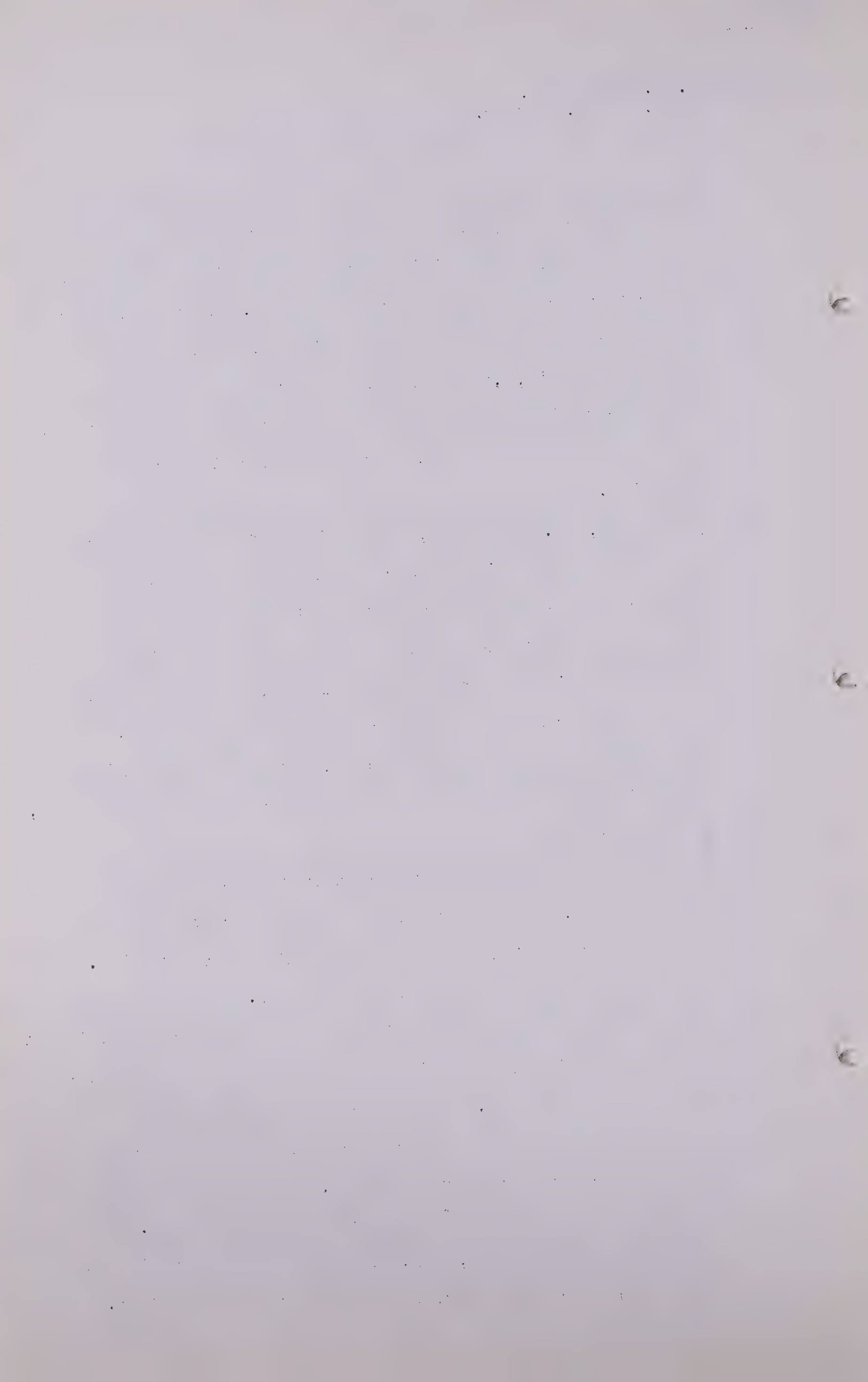
deliverability under the particular economic conditions at the time with limited market to a few of the north central cities of the United States. When their market expanded then the demands of the Panhandle field could not meet it, then what had been considered previously uneconomic suddenly developed as the largest gas field in the United States, if not in North America at this time.

Q Again, Mr. Dougherty, would it not be possible for us to consider this prospect from the point of view of the tangible first and the intangible second. It might well be that the Board would feel it better to do the arithmetic in terms of tangible and apply its judgment to the trends on the arithmetical answer. Now, should that happen to be the process, I take it that this arithmetic is not accurate if interpreted in that light, is that right?

A In the light of the static instantaneous situation as of today. You would want to apply discounts to those very remote fields on the basis of that assumption. I do not know how to apply it myself.

Q But you did have it in mind when you discounted Wabiskaw?

A That is right. That is one so obvious that no mathematics is needed. When we come to the other census divisions where there are local unsatisfied markets and local agricultural markets, I think there will be some exhibits introduced here relating to that. I may mention in passing, say, the matter of generation of local electric power, using natural gas as a fuel.



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It would then be spread over a wide area. There would be small volumes of gas which could be economically used for that sort of an operation. I am in no position to appraise that. I would say, unfortunately that burden belongs to the Board, or rather, fortunately for my view point, and that I would be very cheery about discounts even on the fields some distance from the local population centres because of what may happen within a very short time.

Q What about discounts for gas whose production may have to be deferred on account of oil production? Take a specific case, the Leduc D-3 gas cap.

A We left that out of our available for sale, as you are aware. We put that in a separate category.

Q Is that not included in the 8.4 trillion?

A No, sir. That is one of the things referred back to the original question. I did not add that in on what is available during, say, a 30-year period.

Q MR. GOODALL: Was the Lower Cretaceous not deferred in the Leduc?

A No, it was not because that, I think, is not economically a demand function, not in operational function with oil recovery necessarily, but in answer, the D-3 gas cap is not included in the available for sale total of 8.4, yet in the availability studies which will be discussed later it is brought in at what is thought to be the proper time in the life of Leduc, so that in these figures we started to discuss there is a very close balance. It is happenstance actually, but it is a very

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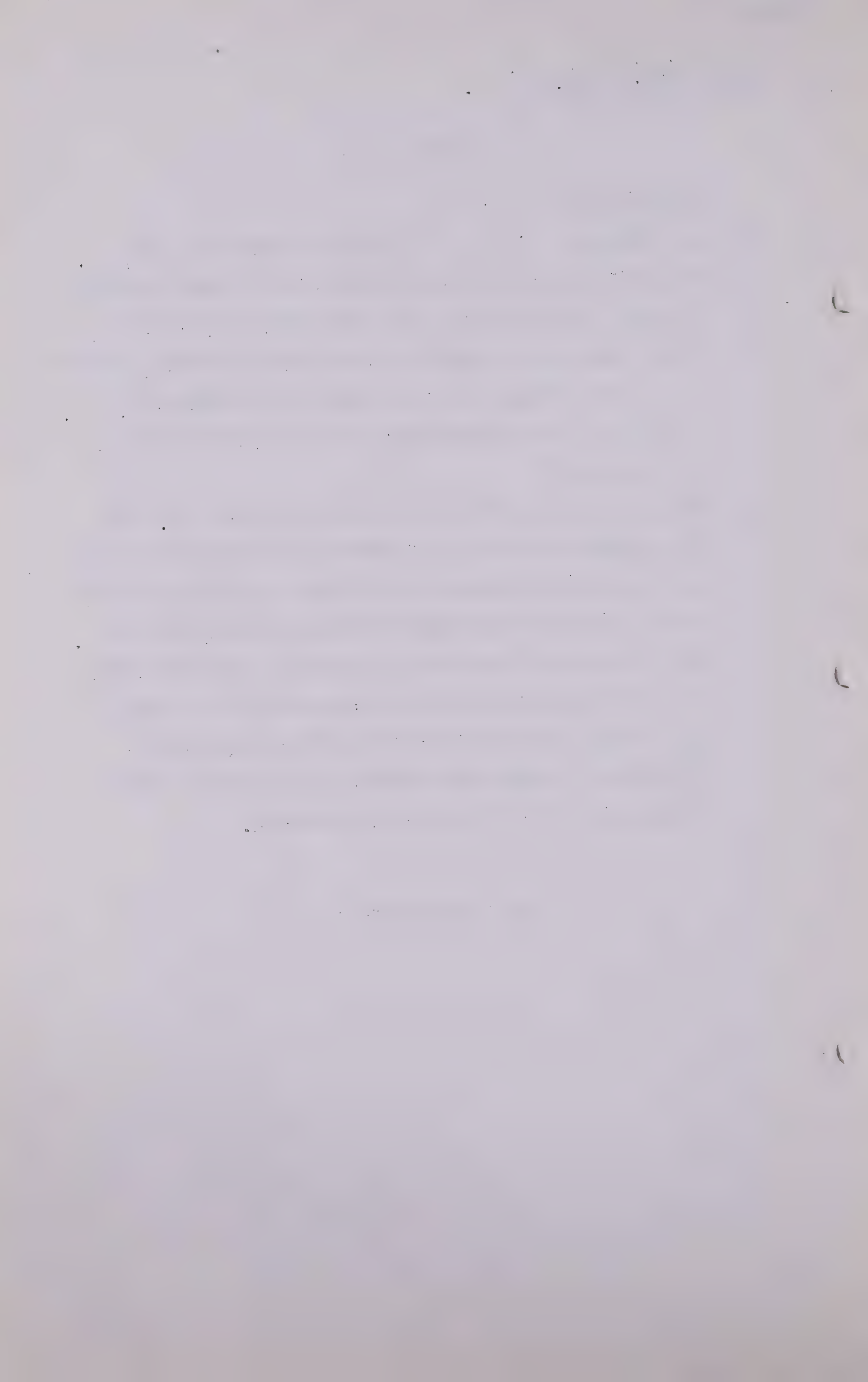
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close balance.

Q DR. GOVIER: I was also wondering, Mr. Dougherty, about the reserves that are in multi-horizon fields. I noticed where you have, say, four sands or three sands in one field, you have added them all together. Is it your thought they would all be available, say, within 30 years although they would not be produced successively?

A There is a good deal of flexibility in that. We made the assumption that if the demand was required as placed on the field by the markets that they could be exploited to the extent of the demand within a 30-year period. The availability studies will show that there are many cases in which only 60 to 85 per cent of the volume of gas shows as available for sale after all the other deductions are actually required or thought as being producible out of that 30-year period.

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Q Yes?

A We chose a realistic, what we call a realistic development in the production system that could be strained further to an additional volume within the limits of operation to produce 100% of the available amount without doing any damage to the reservoir or to the operation. That becomes mechanical based upon our experience as to what the load is going to be.

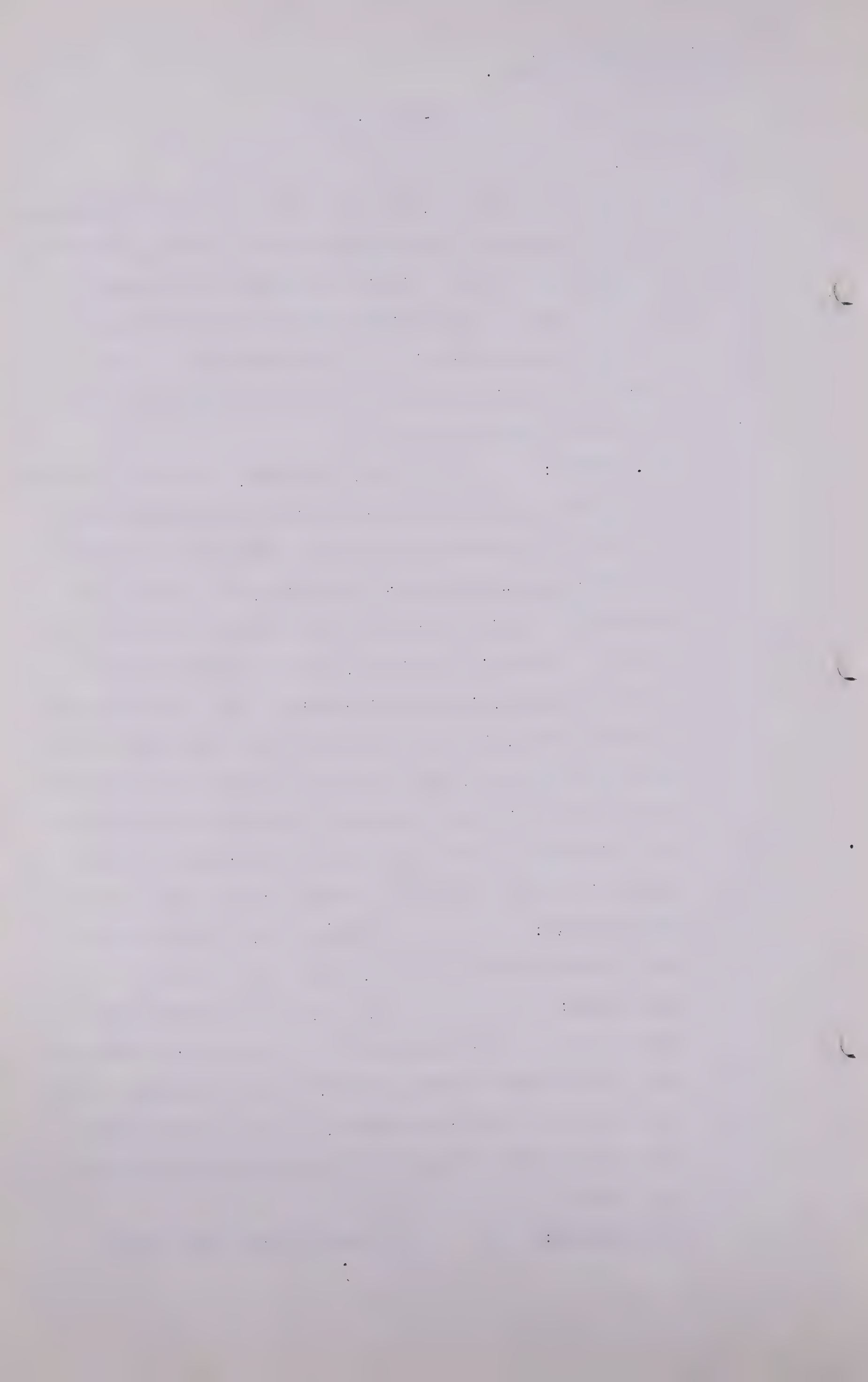
MR. PORTER: Mr. Chairman, I plan to introduce through Mr. Trostel a chart showing the deliverability in relation to Provincial and the combined export load assuming Trans-Canada were exporting, and there is no reason for keeping it back. I was going to work it in with Mr. Trostel's testimony, and it occurred to me it might be helpful in this discussion, and I can prove the factual matter, if it is satisfactory, with regard to the chart subsequently, but I thought it would be useful at this time and it may enable Mr. Dougherty to illustrate the point that is now being discussed with Dr. Govier. I could distribute it at the present time as well as later.

THE CHAIRMAN: I imagine Mr. Trostel will be here to explain it and go into all the details?

MR. PORTER: Oh, yes, but I thought you would have a better understanding of Mr. Dougherty's views if you had the paper before you subject to subsequent proof.

A If I might make the observation, I would rather say a little generally and let Mr. Trostel bear the brunt of the detail.

THE CHAIRMAN: I think we will wait until



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Mr. Trostel is here.

MR. PORTER: That is fine. Mr. Dougherty
may be gone by the time we get to him.

THE CHAIRMAN: Well, I think we will keep to
questions that he would like to answer in a general way.

A Thank you.

Q DR. GOVIER: Mr. Dougherty, in looking at
your 8.4 figure of your arithmetical computation, am I
right in assuming that the use of that figure presupposes
the drilling of one well to each horizon in a multi-
horizon field?

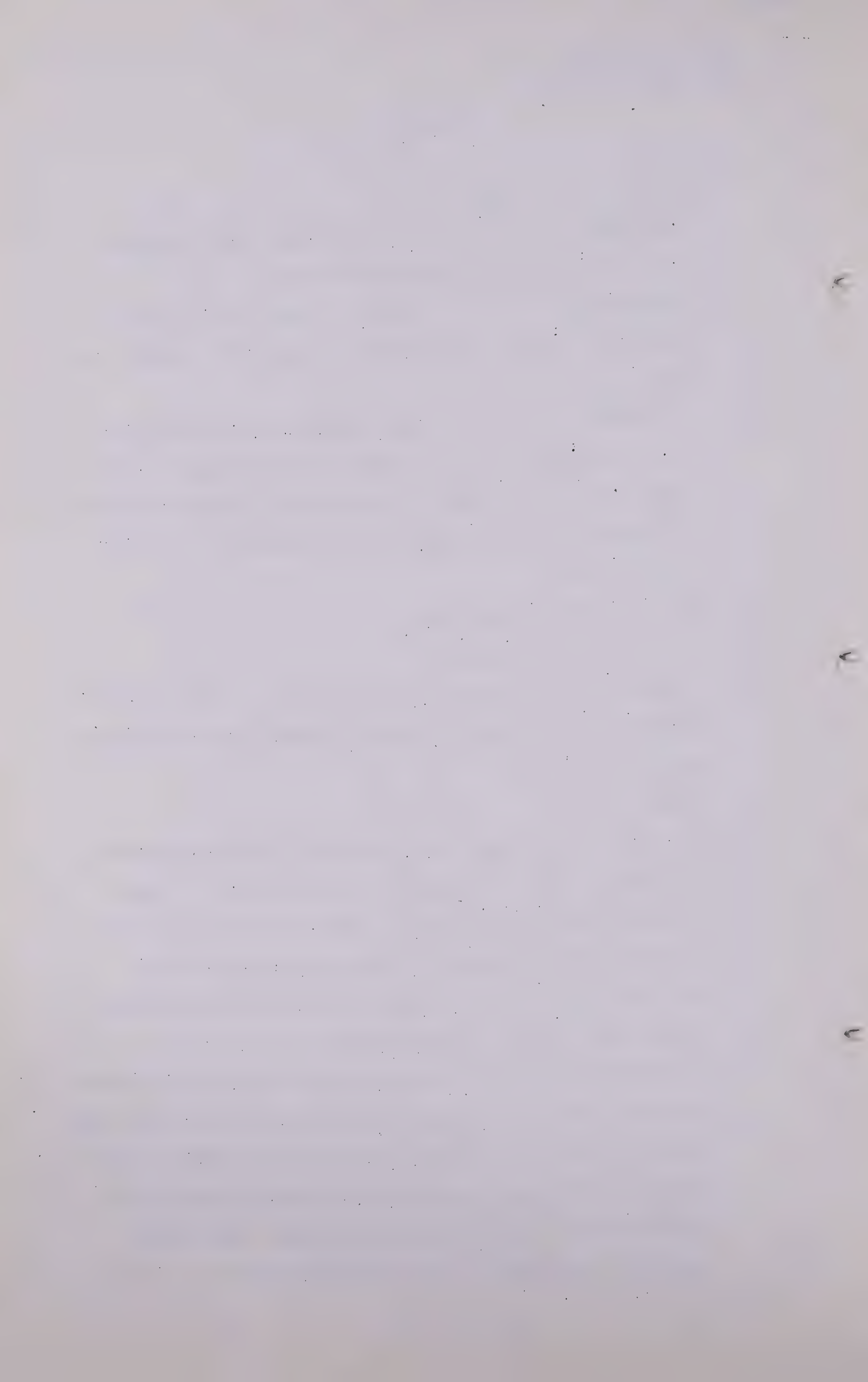
A Not necessarily, no, sir.

Q Would it, in some cases?

A I think in some cases it would be true. However, our
concept was to treat the total reserve in a statistical
sense.

Q Yes?

A And that if deliverability demanded you could complete
additional wells, or make dual completions. Some
of these are smaller sands of limited reserves and they
would perhaps be depleted earlier in a given field.
The complications in attempting to predict what would
be the most feasible operational set-up there are so
complex that we had to treat this on a statistical basis,
that the composite reserve would be produced by the least
number of wells to maintain the deliverability picture,
which could be dual completions or single completions,
and that will vary from field to field. Some would
involve, depending on the effective exhaustion of the



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horizon, some would involve single completions. I think that is best brought out again in the availability details, that is, the number of wells per sand, the number of sand completions in the field.

Q Well, now, Mr. Dougherty, let us assume that the Board is going over your submission, attempting to arrive at a figure that represents gas that is available for sale within the Province of Alberta over the next 30-year period, without superimposing trends at all, on a static basis, if you like, but taking into account, as best our judgment enables, these matters of economics, and would it be your thought that we should first take your proven gas and, secondly, take some proportion of your probable gas, 75 or 85 per cent, and then, scanning the fields, looking at distances, looking at the need for processing plants and all other related matters, possibly making use of Dr. Hetherington's transmission costs chart, and so on, segregate from the total those that do not seem to be within reasonable economic reach, and then go on to segregate from the total those that had to be deferred for a certain period of years, and re-introduce them into the total after that period of years from the deliverability point of view. Is that, in your opinion, a fair way for the Board to interpret your submission?

A There are several shortcomings there, if I may so call them. First, my recollection of the deficiencies in the two utilities' systems as projected by the Board and by the company is that they lie sometime in the future. They

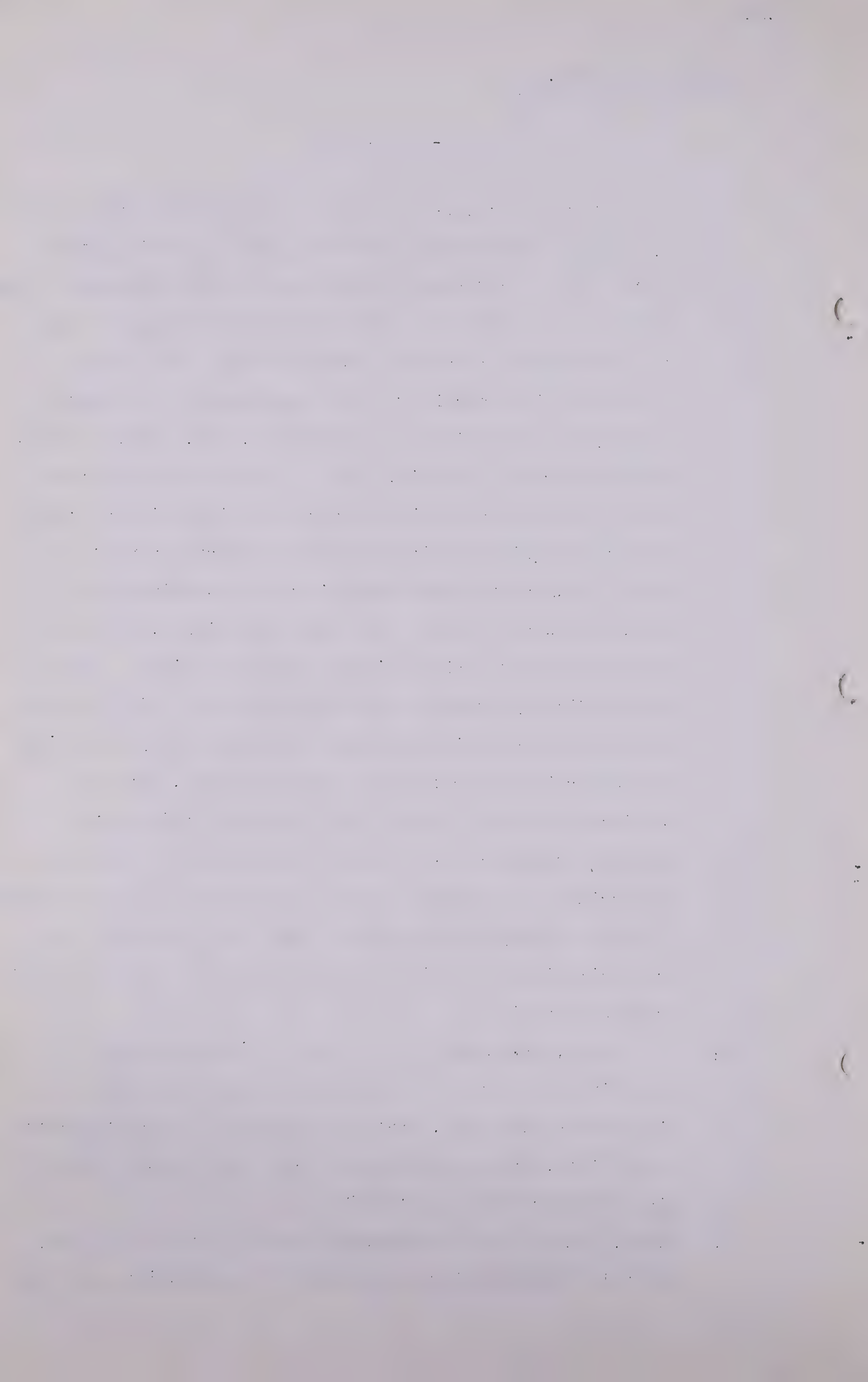
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are deferred already. And then I run into the problem in my own mind that we are deferring again something again for something deferred in the future by all approaches. We would want to add into that additionally then as to what are the markets right now available within the Census Divisions, irrespective of the requirements of the two utility systems which are deferred to, say, 1958, or 1965, or whatever that date is, which I do not recollect right now. Some of those fields which you might discard right now may be quite feasible for power generation uses, or other local heating and domestic and industrial uses. I do not know how I would make that subdivision, but that would be a very serious pitfall, I would think. That is the difficulty because the demands you are trying to take care of are not going to appear tomorrow. They are going to appear 5 or 6 or 10 or 15 years from now, that is projected into the future, but we are not allowed to project the reserves. There are trends that we know are occurring, and occurred in the last year and the year before. It is an incompatibility that I have never been able to reconcile in my own mind, and I am glad it is your problem rather than mine.

Q Of course, Mr. Dougherty, it might still be possible to take into account the trend situation without doing it in a numerical sense, that is, one might do the numerical work first, observe the answer, and then perhaps adjust it in accordance with the trend?

A Well, I like that considerably better, except in the way that it is performing a multitude of computations and then



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applying a very broad percentage on top, so that you almost negate the work that you have done before. One might as well apply a lower trend factor and leave the estimate, as such, since you are dealing with 30 years.

Q I think Mr. Smith asked you earlier if you had read the Act. I believe you will recall that under the Act there is a reference made to gas surplus to the present and future requirements of the Province. If it does not say "future gas surplus", it says "gas", Mr. Dougherty?

A Yes, sir. That is where I run into a blank wall. I have not been able to solve it in my own mind, except I suspected your suggestion of certain discounts, and then taking the trend factor into consideration, would probably be very reasonable, and let us even say conservative, protective in not doing too much violence one way or the other. I think the trend is important.

Q Would you care to give us your views on the Viking-Kinsella material balance problem that I mentioned the other day, Mr. Dougherty?

A Yes, sir. It will take me a moment or two to pull those figures out.

MR. C. E. SMITH: There are whispers behind me that we should have a breather, if that would meet with the approval of the Chairman of the Board.

THE CHAIRMAN: Pardon me, Mr. Smith?

MR. C. E. SMITH: Somebody wants to smoke, in layman's language, in other words.

THE CHAIRMAN: Would you like an opportunity to do that, Mr. Dougherty, during a few minutes' adjournment?

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A Yes, sir, I would appreciate it.

THE CHAIRMAN: All right, we will adjourn for
a few minutes, then.

(Hearing resumed after short adjournment.)

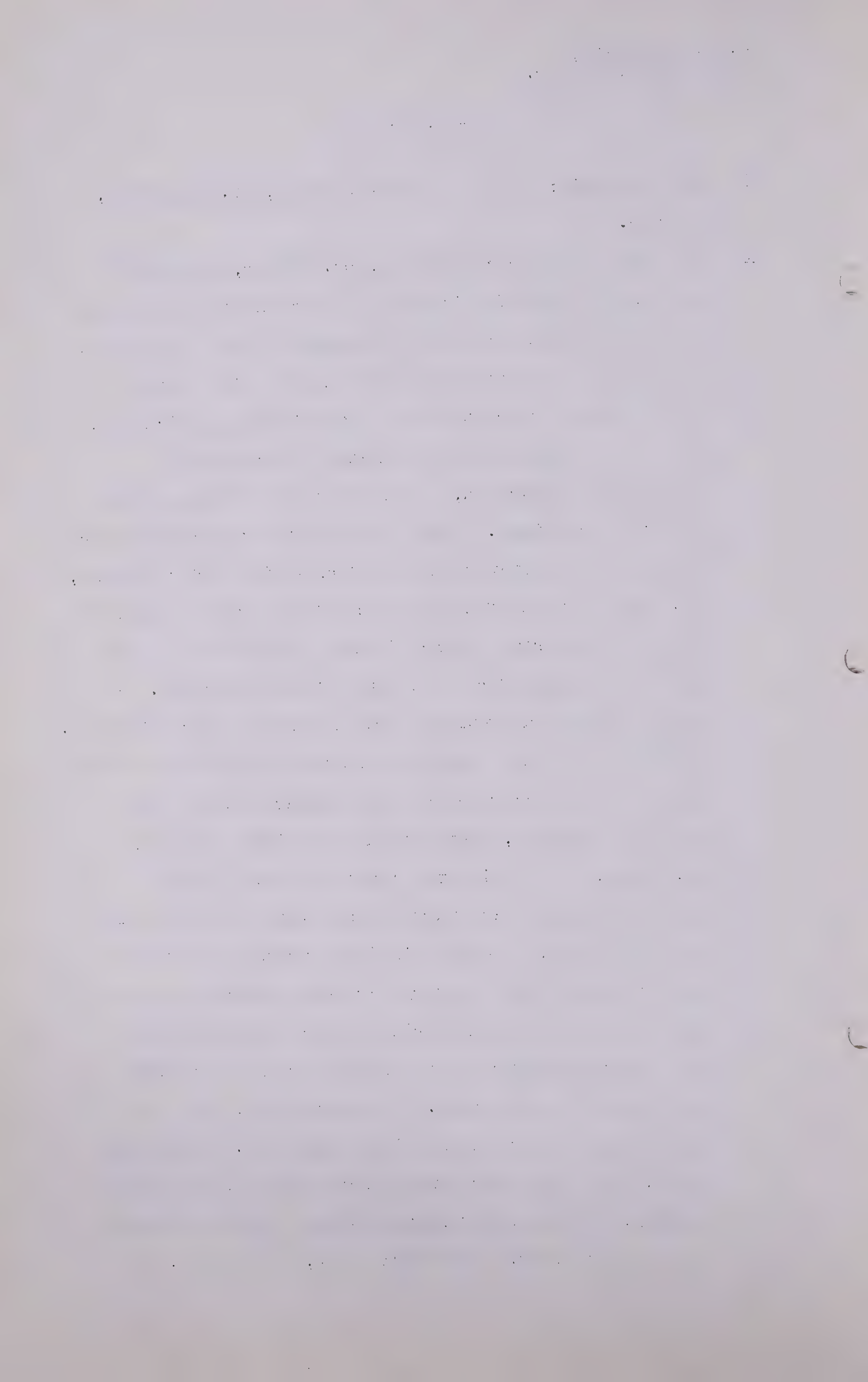
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Q THE CHAIRMAN: Just proceed, Mr. Dougherty, please.

A In answer to your suggestion, Dr. Govier, we tried to analyze the material balance problem in Viking-Kinsella and we find that the control feature as the true answer can only be estimated when you know the full extent of the reservoir since under the Boyle's law application, if we are going to use the change in pressure to cumulative production, we must have the volume of the reservoir constant. That is one of the basic differences between the estimates made so far, is that, for example, Mr. Davis's area of application of the pressure decline method or material balance is more restricted than the area we utilized for the volume of the reservoir. I should think that would be true for most other estimates. I would like you to keep in mind that we went into some length in the occurrences of gas saturation in substantial quantity, went outside the limits shown by Mr. Davis, and outside the limits we have shown as proved, irregular and varying in volume but a definite gas saturation. The top line on a pressure decline projection in white is very crudely indicated in the extrapolation of our material balance estimate with an original pressure in the reservoir of 910 pounds per square inch absolute. In other words, that is the pseudo pressure at initial conditions. The second point, 856 pounds per square inch absolute, or approximately, is the 1945 weighted average pseudo pressure for the reservoir. The third point, 812 pounds, is



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the 1950 pseudo pressure. The colored points are for different areas.

Q MR. PORTER: Just a moment before we go to the colored points. For the record, is the white line the one that is duplicated on page 8?

A Page 8 of census division 10, Exhibit 10, yes, sir. The colored points represent other combinations of areas as of 1945 and as of 1950, this being plotted against the same cumulative production as the points shown in white on our chart. First, let us take a look at the point in red designated 796 pounds per square inch absolute, which represents weighted average pressure of the reservoir in 1945 to the limit of the pressure contours as of that date, assuming there is no reservoir out beyond that. If we used that as a control point and attempted to estimate the reserves and project them into the future, the answer would be approximately 670 billion plus or minus to zero pounds square inch absolute.

Q DR. GOVIER: You would use the same starting point, would you, Mr. Dougherty, of line 10?

A Yes, sir, original reservoir pressure. Now, if we compare that now with the point that is also to the 800 pound per square inch contour in 1950, covering a larger area due to the depletion of the reservoir, to the extension of wells out beyond the area under drainage in 1945, we have the point 753 pounds marked in blue. In other words, any change in the volume of the reservoir in the pressure decline computation throws you off.

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The first extrapolation was inherent, we were not dealing with the reservoir, we were dealing with a section of it, a portion of it, so a curve drawn from 910 to 796 to 753 is concave, it is not performing to Boyle's law.

Now, let us take another example. Let us now take the 1945 cumulative production and add to the area outside the 800 pound contour in 1945 the area that we know as being under drainage in 1950, but in 1945 this was virgin conditions, we have then weighted in the area known in 1950 to be productive at virgin conditions with the area in 1945 actually under drainage, the two points then which might be used as a projection to the ultimate recovery would be 826 pounds and 753. Those two points then represent for our common reservoirs in time in volume. We have corrected for the expansion of the production between 1945 and 1950, attempted to correct our first error in assuming too small a reservoir. If we extend and extrapolate that trend of pressure versus cumulative production, we get the answer of approximately 860 billion cubic feet. Now, that is merely an adjustment in volume considered in the weighting of the pressures due to the features which developed between 1945 and 1950. Assuming an area or volume of reservoir that is too small produces a reserve estimate that is too small because later developments will show that that area is in error, Boyle's law is not functioning automatically, there is gas coming in from the outside on the arbitrarily chosen area but yet you are not

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weighting those pressures in, you are only weighting the depleted pressures within your chosen area.

Now, let us take the next case on our map, page 6, Exhibit 10, census division 10. We weighted in the area that was developed by the scattered wells to the east, southeast, of the main pressure sinks around the Kinsella wells within our proved area.

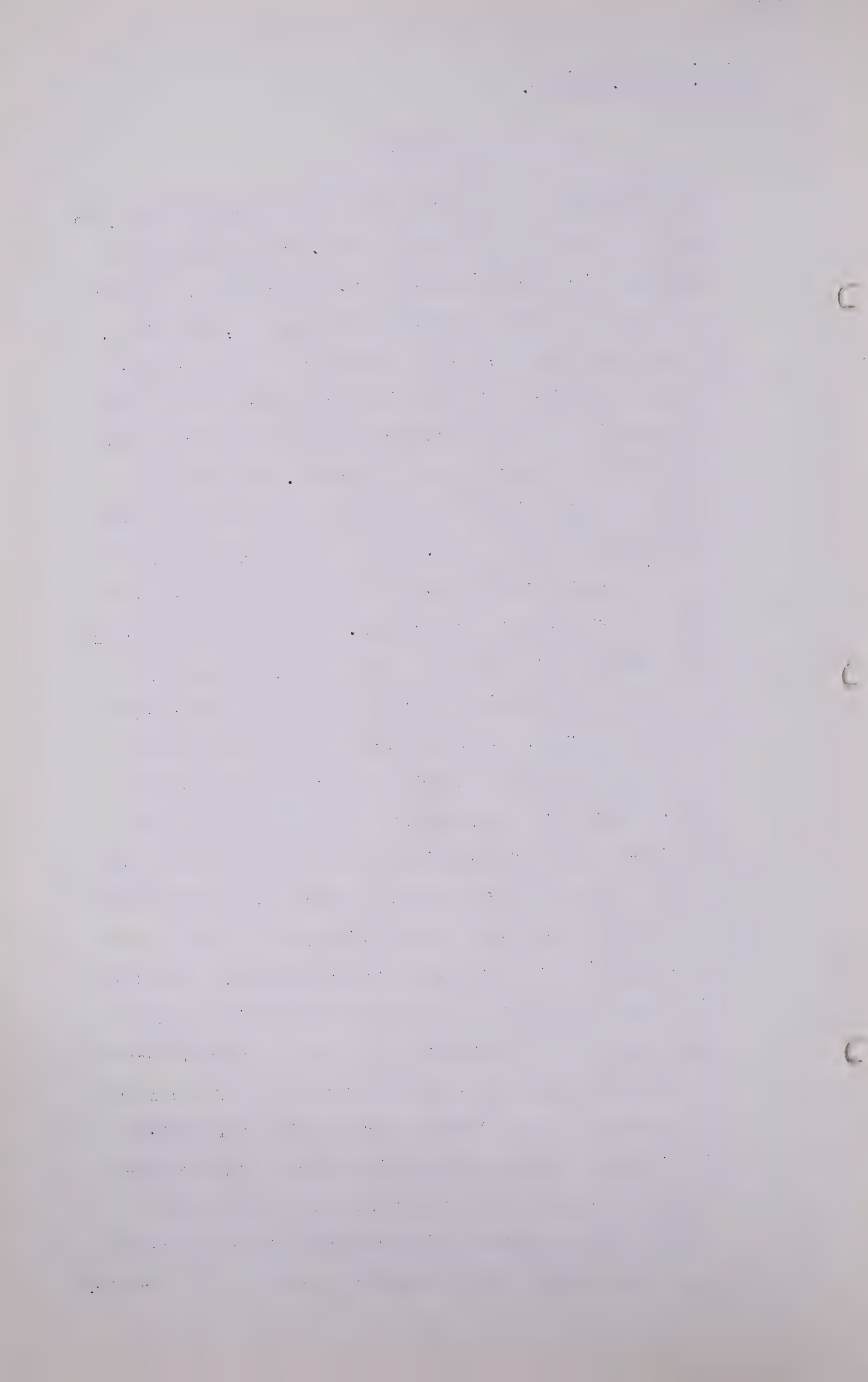
Q That would not extend right down to Fabian, would it?

A I will check the map. That escapes me at the moment. That area goes to the 10-foot isopach line and extends over to Fabian, including Fabian. Weighting that area in as part of the reservoir as evidenced by the development of gas in these areas, utilizing this same area in 1945 and the same area in 1950, weighting in that portion of the total area that is not under depletion at original pressure, we obtain the points corresponding to a pressure of 846 pounds per square inch absolute in 1945, and 788 pounds per square inch in 1950. The extrapolation of those points through the original pressure would yield an ultimate reserve estimate of 1.1 trillion. It is inherent then in our viewpoint that the pressure decline method is restricted in application to within the limits of your knowledge of the extent of the reservoir, and that so long as any gas saturation is left outside of the computation of weighted average pressures the reserve estimate is going to be low, you do not have the correct answer. You can err the other way, however. You can assume too large an

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area in which your weighting would continue to draw, to make a straight line relationship. One could have a hypothetical weighting on a trend which would be above the trend shown on our Exhibit at page 10, Exhibit 9, census division 10, on the weighted average pressures within our proved and probable area which lies within what we feel is the total area of gas saturation that is affected in part of the reservoir. Our pressure decline correlation is incorrect to some extent because it can not weigh in that, it does not include that part of the reservoir lying outside of proved and probable areas which have gas saturation. You could weigh in an even larger area going well outside any or all gas saturation and obtain a straight line function because of the uniformity of the choice of the total area and you could have points which would fall on a straight line. Therefore the judgment of the validity of the material balance calculation is restricted to the knowledge of the extent of the saturation. Anything within that is too small and the probability of erring on the small side is greater than on the high side. This line of extrapolation that is weighted too heavily by an area outside the reservoir limits will eventually come to the true line down in the history of the field when the pressures in the central part of the field which are actually under depletion will tend to fall faster than your calculated extrapolated line due to the absence of any gas coming in from the outside or from your area assumed to be reservoir which is not reservoir.



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So that at some time in the history we will get an approach to the real line.

Let us say we have a true Boyle's law relationship for the Viking-Kinsella field, and arbitrarily I am going to place it above our line, if I may, something on such order that even weighting eventually it will approach, but in this stage of the history of the Viking-Kinsella that can not be told by analysis of the points except in relationship to the history of the assumption of areas known to be too small and the trend of the pressure cumulative extrapolations as your drainage areas expand, so that by trial and error, in effect, you have a series of parallel projections until such time as in your own mind or in the light of drilling and knowledge of the reservoir you have taken into account ultimately a weighting in the pressures of the true reservoir that corresponds to Viking-Kinsella.

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Q Yes?

A The other areas would be either inside or without that area, so that there are limitations, marked limitations to the application of the material balance method, unless the areal extent and the volume of the reservoir is known rather closely.

Q Mr. Dougherty, all of your weighted average pressures, are they done on a volumetric basis?

A Yes, sir.

Q In this illustration?

A Yes, sir.

Q Did you have an opportunity to check the estimates that you have obtained by volumetric methods using the same reservoir volumes as shown by this particular blue line?

A No, that did not occur to us to try that. That would be another check. There, again, the areal problem, I think, would bring you right back to a close correlation between the two.

Q You would get an apparent check, even though the answer might be the answer of your yellow line?

A Yes, that is true. The reason you have to check that by reasoning that you would restrict yourself in the smaller area to a higher average thickness, and assuming that you came to the edge of the area, and dropped to zero on either gas or sand saturation, now, if you assumed that you went to zero at the edge and cut back your thickness, you might get a close check, but we are convinced that the calculations must go back to the reservoir again, to what we can best determine as the extent of the reservoir. Any arbitrary area less than the extent

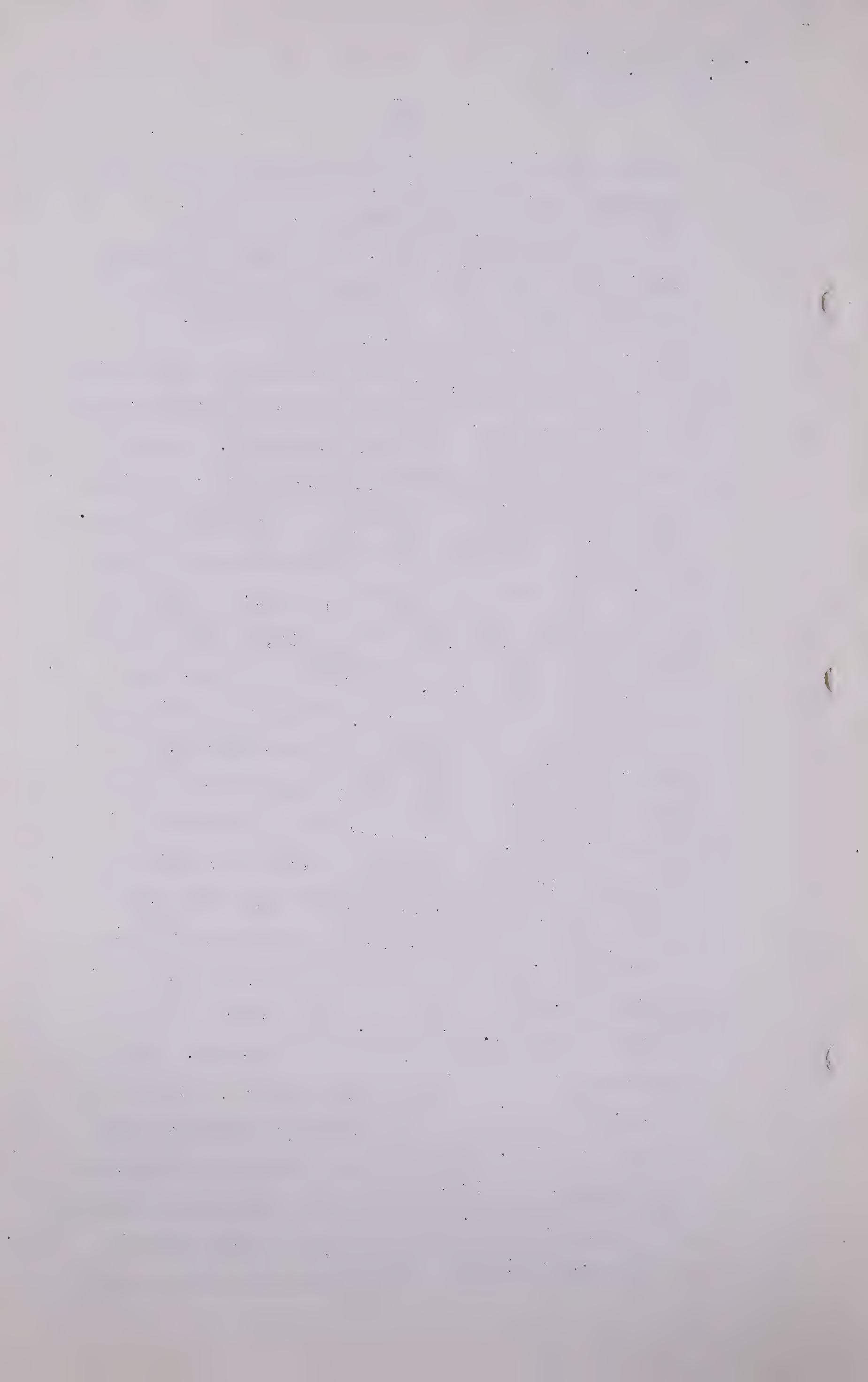
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of the reservoir, or over, is going to give an erroneous material balance calculation.

Q But it may show up by means of a curved line in such a plot as you have drawn, provided you have the same area for each?

A That is correct. The only clue you get is this tendency of connate curvature, concave curvature when your large areas are depleted. You get the concave curvature in your large areas as depletion progresses. So that a series of areas, as the history of the field progresses, will begin to give you the ultimate reservoir volume. Now, we feel that the evidence of the wells scattered outside of our proved area would indicate that the gas saturation is part of the reservoir, and that this extrapolation of ours, as shown on page 10, Exhibit 10, is probably on the low side. If our weighting on thickness is not violently off in magnitude, it would take a very great variation in that to appreciably change the weighting. We are confident that on the basis of the changing areas of the depletion between '45 and '50, that the trends indicate that the projection, the true projection, is something in excess of 1.1 trillion ultimate, something upwards of that, which, in our best judgment, is 1.5 trillion. I do not think any greater precision can be obtained mathematically. It would be a judgment of the size of the reservoir and the matter of weighting. In a normal material balance calculation of oil reservoirs, that is still the difficulty of getting the volume of oil to make a consistent picture and one that is within the known geologic and engineering factor.



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Q Well, then, Mr. Dougherty, in looking at, first, your pressure decline calculation, done graphically on page 8, the Board should probably put more weight on the manner in which you have arrived at your volumetric averaged performance than on the fact that the three points happen to line up in a straight line?

A Oh, yes, sir.

Q And also in looking at page 3 of the same submission and the comparison between the results of the equal pound loss method and the volumetric method, we should again put more weight on the areal extent you have assumed than on the apparent check by these two different methods?

A That is correct. I think it is basic that you have got to conceive of a reservoir saturation in its entirety, thick or thin, because Boyle's Law says that the function of the reservoir will not reproduce itself mathematically unless that is substantially correct. We would base our estimate then upon what we feel to be true, that the gas saturation in Viking-Kinsella extends outside the limits of our computations.

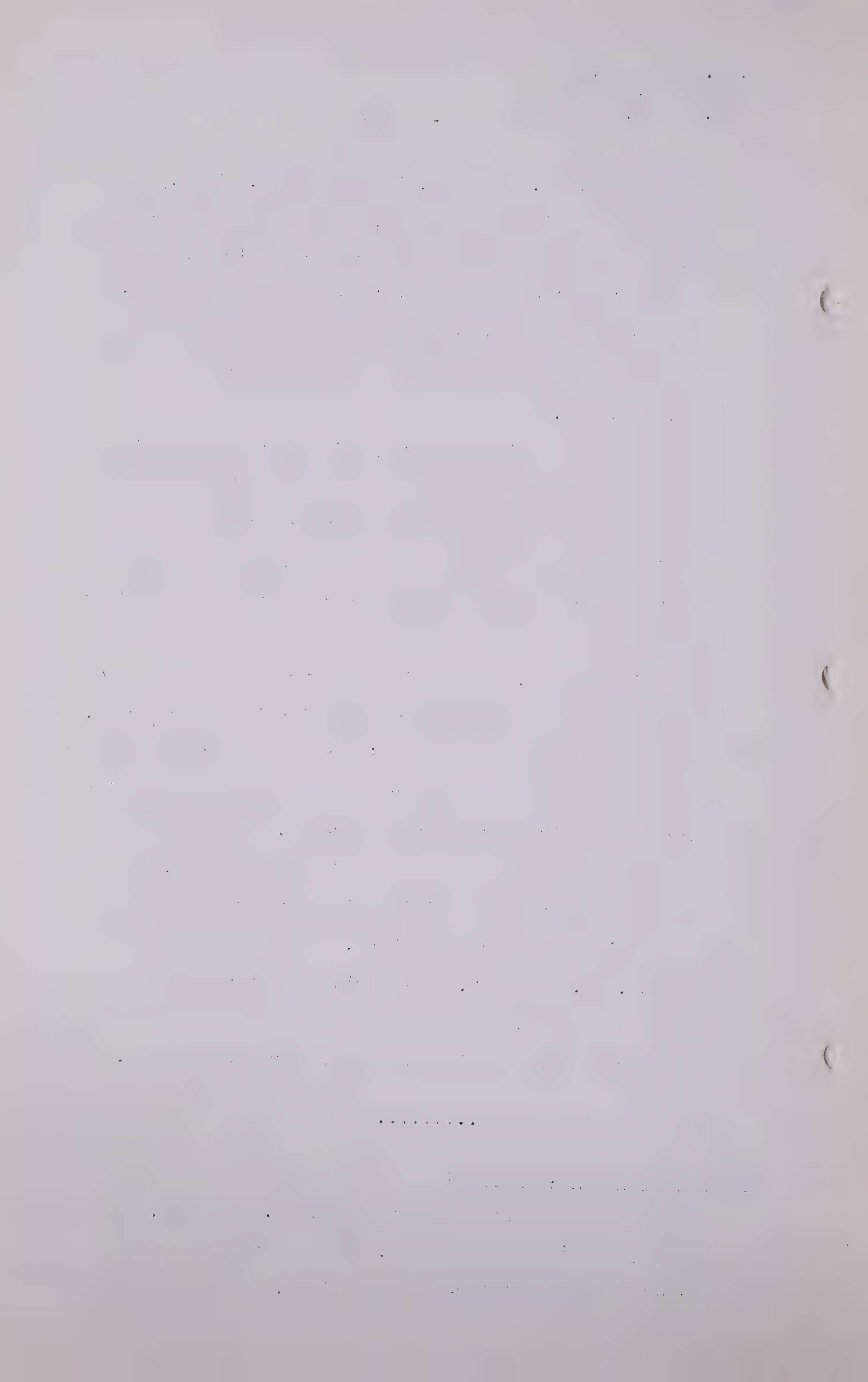
Q Thanks, Mr. Dougherty, I appreciate your careful answers to my questions.

A We learned quite a bit ourselves, I can assure you.

.....

EXAMINATION BY MR. GOODALL:

Q I have a few questions to ask you, Mr. Dougherty, and I hope it won't take too long. I do not like to keep harping on the Viking-Kinsella Field. We will use the



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same map and I will question you on the Manville-Clayesmore area. You will remember that I questioned the productivity of Manville No. 1 well last May when we had your first presentation?

A Yes.

Q Have you looked up any more with regard to Manville No. 1?

A We have no more complete record than we had then.

Q I believe at that time you had a record of something like 11,000 cubic feet per day?

A From some place.

Q To occur somewhere in the hole?

A Yes, sir.

Q You did not know whether it was coming from the Viking or not?

A That is correct.

Q Yes?

A We did not attach too much importance to that one well, and it does not appear in our calculations.

Q But it is circled here as in the proven area?

A Yes. There is certainly proved gas saturation of that one well certainly in the Viking. I think it would have been better if we had only circled the No. 1 well with 3 feet, which we had on the electrical log. I think if we were doing this again we would eliminate about half of the blue area there.

Q Oh, I thought you had done it again when you put it in Volume 3?

A That was an oversight.

Q I see. The Northwest Clayesmore well, you say you had a drillstem test on it?

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A My recollection is, I had better check that since those records are poor.

Q My own observation on that was that they did not drill-stem test but the well blew in when they were abandoning it, pulling casing from the bottom of the zone?

A That may well be it. It is true the Manville well was drilled later.

Q It was drilled expressly for gas?

A Yes. The Northwest Manville, did you say?

Q The Northwest Claysmore?

A The Northwest Claysmore?

Q Yes?

A Your notations are the same we have. Gas estimated at 2 million cubic feet per day from 470 feet when abandoned, and the top of the Viking is shown as at approximately 455. There is a distinct electrical log resistivity and self-potential key at that depth where the gas flow was noticed. That is the basis of our assumption.

Q You did not have any core analyses -I mean, any core examination?

A I have no record of that being cored.

Q Well, then, I take it then that the area outlined here was apparently on the information you had on these two wells without any other control?

A Yes, sir.

Q I just wanted that cleared up. I thought the Board might wonder where that came into the category of proven near the top or bottom?

A That is one well on which I would let Dr. Govier apply a substantial discount.

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Q You would not want it taken into the proven area or category?

A No, sir. I know we have some errors and misjudgments. However, we are convinced that well has 3 feet of plus or minus saturation.

Q The Manville No. 1 well, according to our records, was plugged back and perforated in the zone above the Viking when they got that small flow?

A Well, that was the one where they perforated numerous horizons?

Q After they had plugged back the Viking?

A Yes. Of course, we did not have electrical logs, and therefore not knowing quite where the Viking would be.

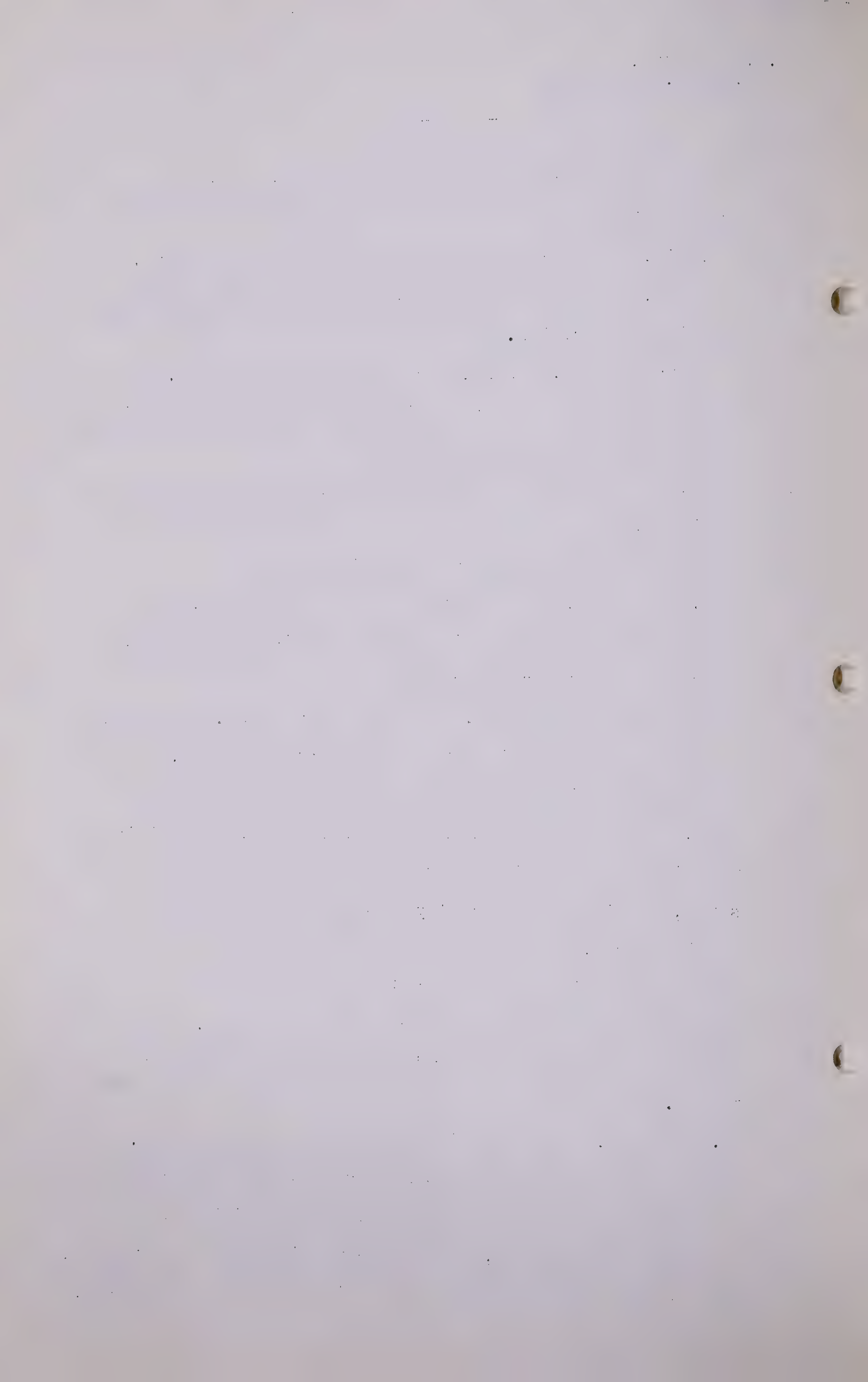
Q There was an electrolog on it?

A We have no record of it. There may well be. At least, it was not released into the electrical log check. We attempted to find all the logs, but some we did not have. We interpreted some, as you will note, some Viking as being developed in the other Manville well to the south, but in such a quantity that we left it in the possible area.

Q Was there a drillstem test on it?

A Our data does not show whether there was or not. We have not been able to determine whether that was tested or not.

Q Mr.Dougherty, from your discussions the last few days, I have assumed that you have considered all of the proven and probable reserves to be in a category which could be developed economically, I do not mean distance from markets, but I mean the percentage of dry holes to productive wells,



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and the cost of drilling wells being taken into consideration

A Yes, sir. As I mentioned today, probably in many cases in our concept, they are in the slightly lower category of proved undeveloped.

Q Yes? Would you consider the undeveloped reserve in a category which could be developed economically?

A Yes, sir, without restriction of time, however.

Q This was without restriction of time?

A Yes.

Q Even if it went up to a dollar for a thousand of gas?

A Not quite. In other words, sufficient volume that it would have some merit in producing it.

Q And that it would pay for the drilling of the well?

A Yes.

Q And pay for the dry holes that might be drilled?

A Not in our problem.

Q But there are some that you have in the probable category?

A Well, that is the dry hole definition again.

Q Well, I do not mean dry holes, but I mean holes that would not produce sufficient gas to pay expenses and warrant completion?

A Yes, sir.

Q I think that is all I have.

MR. STEER: I wonder if I could ask one question, sir?

THE CHAIRMAN: Yes, Mr. Steer.

.....

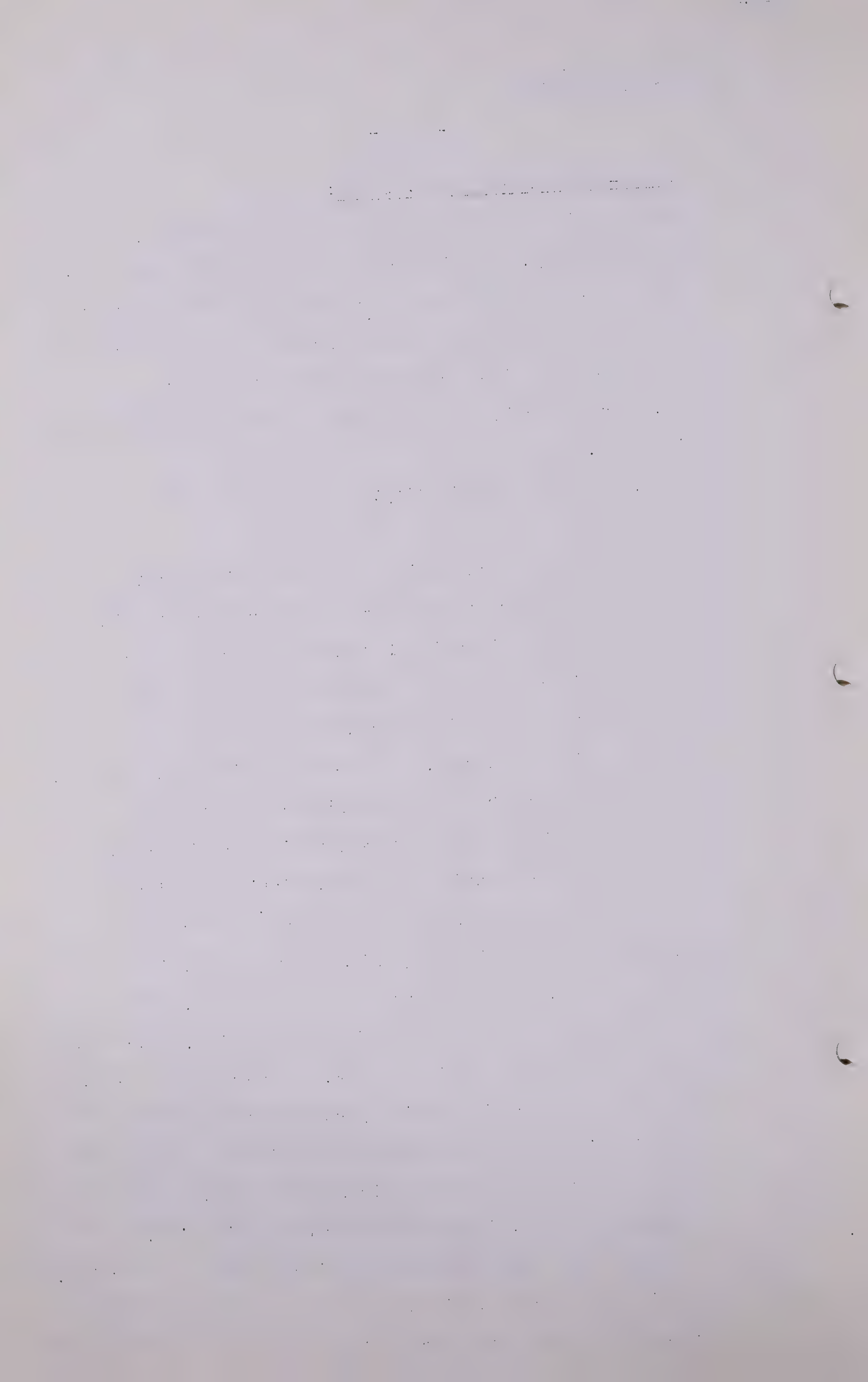


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Cr. Ex. by Mr. Steer.

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CROSS-EXAMINATION BY MR. STEER:

- Q Dealing with this diagram you have on the board, Mr. Dougherty, is this a possible suggestion that your volumetric estimate would give you more than a trillion feet and the pressure decline against production method would give you less than half a trillion feet?
- A Oh, I can conceive of the factors being so arranged that it could, yes.
- Q Well, that is a possibility?
- A Yes.
- Q What would your explanation be of that situation?
- A Well, I would accept pretty well the pressure decline. If I found that situation I would assume that there was a considerable lack of knowledge in one or more of the factors that did not balance out in the volumetric estimate. Again, it is the function of weighting, as to the effect from the data with regard to some of the variations that those assumptions would make. It would take a relatively large variation in either thickness or connate water saturation to throw your volumetric calculation away off, and normally, if you have selected, say, the cream of the gas sand, the highest permeability and the highest porosity, your connate water saturation will be low, therefore, the acre-feet of pore space is partially compensated for by the reduction in the connate water saturation. By the same token, if you take a wider thickness of sand, a greater thickness of sand, including lower permeabilities, your connate water saturation would be increased in proportion, not directly such that it would tend to pull down the acre-feet of the pore space. So that does take some very



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wide differences in large areas, wide differences in basic assumptions.

Q Thank you.

.....

EXAMINATION BY THE CHAIRMAN:

Q Mr.Dougherty, I would like to ask you one question. Dealing with that Ranfurly area this morning in reply to Mr. Smith, you said that some portions of the gas would move to the central part of the field?

A Yes, sir.

Q Leaving the inference that a portion of that gas would not migrate?

A Well, that is that time factor again. In other words, it is the old story that you have about one well bringing in a gas field. It is a theoretical possibility, and perhaps an actual possibility in a long period of time. What would be more practical, in my viewpoint, is, with regard to the Ranfurly No. 1, that it would be a commercial well at 6 million open flow, that it could be produced, and by reason of its production develop a pressure sink, a pressure table area in the vicinity of the well which affected the drainage rather than the long-distance drainage from the Viking area.

Q Well, then, you feel that by taking terminal pressure at 100 pounds, that you would not need to take any additional discount for unrecoverable gas in the reservoir by reason of poor permeability, and referring particularly to this area where you have a very narrow porosity sand, shaly sand, across a fairly large neck here in your outline

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of the field.

A I would like to check and see what we did use as the terminal pressure. It escapes me at the moment. I had the recollection that it was 150 p.s.i.a. rather than 100. I think that is a pretty ample cushion. 150 pounds is a substantial proportion of 810 pounds wellhead. That is a larger percentage than normally experienced in some fields, dry gas fields.

Q By taking that terminal pressure before you have made ample allowance for any gas that might be trapped or unrecoverable by reason of the poor permeability in different parts of the field?

A Yes, sir, that along with eliminating the possible area where we know there is gas saturation, and in certain portions of the field that will come into play, will produce gas by the extension of the pressure sink. In other words, there is a twofold cushion there. In the case of the Kinsella, the possible is a cushion in that direction.

Q Thanks, Mr.Dougherty.

.....

EXAMINATION BY DR. GOVIER:

Q I suppose, Mr.Dougherty, we would be right in interpreting that terminal pressure as a volumetric weighted average, and taking into account the possibility that the high deliverability wells in the centre might be drawn down to 25 or 50 pounds?

A Yes, sir. That is the usual fashion in which the reservoir operates. There is lateral equilibrium across it, and

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taking such fields as Monroe, as being an example, there were wells at 150 pounds, there were wells at 1000 pounds in the tighter portions of the area, and in the Panhandle Field while we had wells at 25 pounds well-head, they were pulled down to 15 pounds line pressure, producing volumes of gas, whereas other portions of the reservoir were as high as 400 pounds. It is a large area so that the terminal pressure is assumed to be a weighted average.

Q I think you will be glad to know that you are through, Mr.Dougherty.

MR. C. E. SMITH: I think Mr. McDonald has been trying to get up, sir. I should have said he was trying to speak, not get up.

MR. D. P. McDONALD: I had a couple of questions to ask Mr.Dougherty.

THE CHAIRMAN: All right.

MR. McDONALD: They are arising out of this afternoon's examination. However, I can wait until Monday, as Mr. Dougherty is going to be here, I understand?

MR. PORTER: Yes, he will be here. I have two or three things that I want to go over with him, but they can wait until Monday.

THE CHAIRMAN: Will your examination take verylong, Mr. McDonald?

MR. McDONALD: If you wanted to, I can start.

THE CHAIRMAN: Yes, go ahead, Mr. McDonald?

.....

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CROSS-EXAMINATION BY MR. McDONALD:

Q Mr. Dougherty, it is just with regard to this matter of the percentage of the matter that was dealt with by Dr.Govier. When Mr.Smith started to examine you he referred to the Act under which we are holding this Hearing, the Gas Preservation Act?

A I do not know who referred to that, but it was referred to.

Q He pointed out that the primary instructions to the Board are to deal with the requirements with regard to the supply of gas for Alberta?

A Yes, sir.

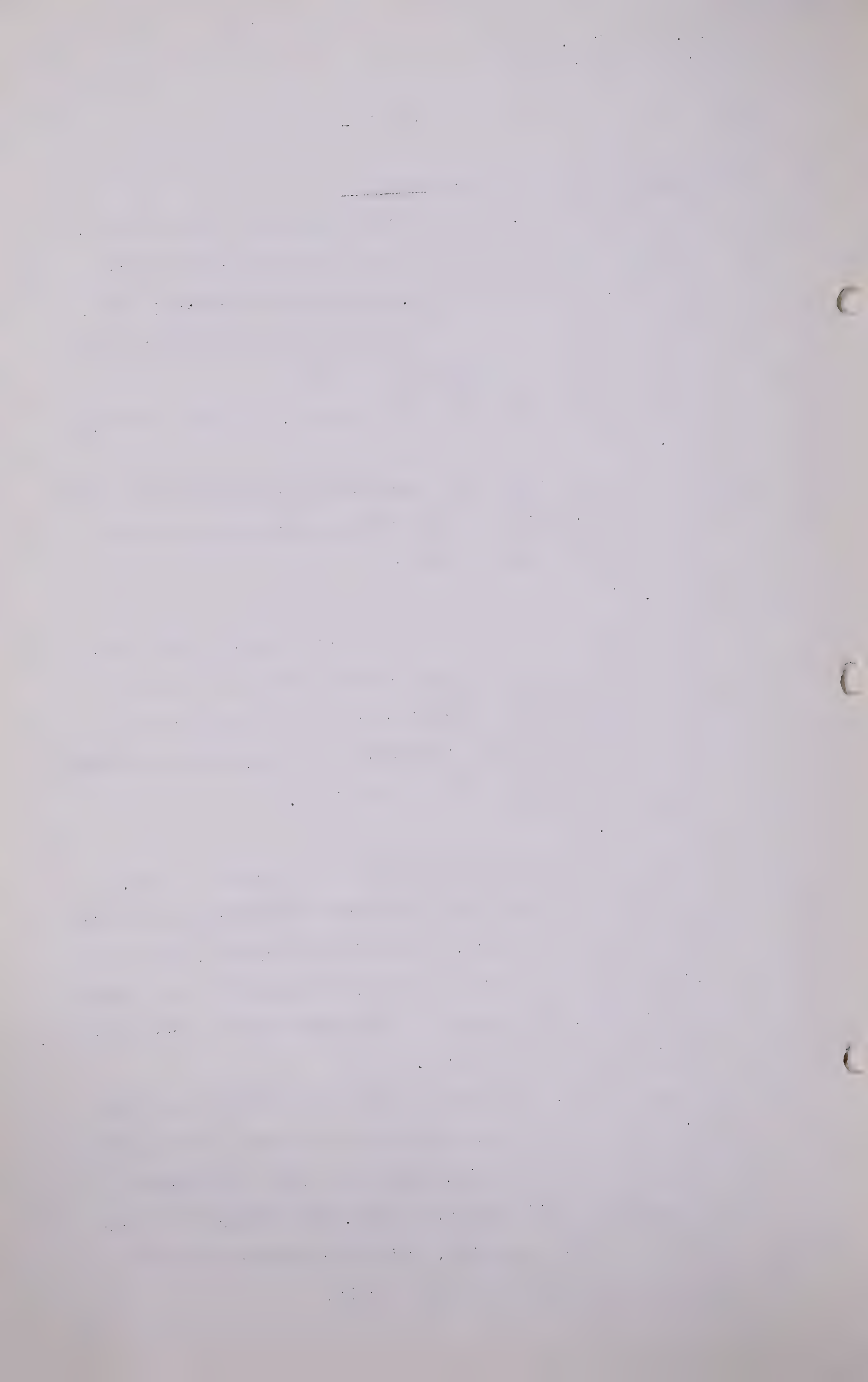
Q And then he referred to the section where it says that the Board shall not grant a permit for the removal of any gas from the Province unless such gas in the opinion of the Board is surplus to the present and future needs of the people of the Province.

A Yes, sir.

Q Now, I was just going to ask you or suggest to you, there might be one degree of proof regarding the requirements of the Province, there might be another degree of proof regarding what the surplus is after that has been ascertained, with regard to the export out of the Province?

A I think that is quite true.

Q In other words, the eventual use of the surplus gas is going to be or will depend on the judgment of the people who are going to use it, that is to say, the people who are going to build the pipe line, the producers who are going to drill the wells, and the consumers who are going to consume it and pay for it?



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A All some time in the future, with indefiniteness as to how it transpires actually.

Q I am speaking only of the surplus?

A Yes, sir.

Q Now, am I right in interpreting your remarks to Mr. Steer with regard to the reliability we should place on your estimates, that you felt that that would be acceptable to your clients as to the surplus gas, and would be acceptable to the pipe line company, and you thought it also acceptable to the consumers who might be interested in purchasing the gas?

A I hope so.

Q I mean, did you have that in mind?

A Well, the consumers are a rather indefinite entity, and I think the Board, perhaps, is going to have more to do with that than the consumers.

Q No, under the Act the Board's requirement is to ascertain what the people of Alberta were going to do. I am thinking of the people who are going to buy it outside of the Province?

A Oh, I see. I would say yes, sir.

Q In other words, even though this Board did say that this gas is available, the people who are going to invest their money are going to look into it on their own account, having regard to the investment they are going to make?

A I would think so.

Q And they will have an independent judgment, apart from that of this Board, or any other Board that may deal with the matter of supply.

A I do not know that it will do them much good though, but

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it may have.

Q Well, on the assumption that that is the case?

A Yes, sir.

Q That this gas is surplus?

A Yes, sir.

Q And the permit has been granted?

A Oh, yes, sir. I am sorry.

MR. C. E. SMITH: With that assumption you
fellows will toss a coin, is that what you mean?

Q MR. McDONALD: Looking at the proof, you
agreed with me that the question of the requirements
of the Province of Alberta, and the portion of the gas
that is to be consumed in Alberta, may, in this Board's
judgment, require more proof than you, in your particular
judgment would require to invest your money in the surplus
after the Alberta requirements have been deducted?

A I think so. Under the Act, as set out by Mr. Smith,
the requirements for the Board to follow are quite
stringent, which is a projection of several things into
the future, and which is always difficult, and we attempt
to be as exact as possible. The risk investor probable
does not look to the exact proof so much as the combination
of proof plus the trend in the entire development and
economic situation. If that were not so, I doubt very
much if we would have very many wildcats drilled by
very many of the major oil companies with substantial
insurance companies' loans and bank company loans.

Q However, that is just another type of approach to this
question of the degree of proof?

A Yes, sir.

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Q Having in mind the ultimate use of any particular gas from any particular field?

A Yes.

Q Now, just on the general point of this probable and possible; You anticipate that a great many more wells will be drilled before the available gas is actually at the wellhead?

A Yes, sir. That would be a function of when the demand hit the particular field or group of fields.

Q Yes?

A If the applications or application is granted. The physical performance of the delivery of the first gas is deferred some years, 1, 2 or 3 years with regard to the question of any export, or any major interconnection, or connection of these fields to the local utility system.

Q Or to any other market?

A Or to any other market.

Q And there is a good possibility that those that are probable that you have set out in some of these fields, that may be a great many of them will not actually become proved until there is a market available to bring about the demand?

A I would think there would be a time when the very large-scale drilling program would meet up with the matter of diminishing returns, even with a lack of markets, and even though exploring for oil.

Q So that we get to the problem whether they are going to have a permit before they do this development drilling, or whether they do this development drilling before the permit.

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Cr. Ex. by Mr. McDonald
Re. Ex. by Mr. Porter

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MR.C. E. SMITH: Oh, do not ask him that question.

.....

RE-EXAMINATION BY MR. PORTER:

Q Mr.Dougherty, just so that we will not leave on the wrong note, and I will have some more to say to you on Monday, there are not any degrees of proof in the proven and probable estimates that you have made, they are all of the one standard?

A We have attempted to do so, yes, sir.

Q They are not one standard, there is not one standard for the domestic needs and one for speculative activities?

A That is correct.

Q They are all of one standard?

A That is correct.

MR. McDONALD: I am not suggesting that.

MR.PORTER: I know that, but the inference was there for anyone to apply.

THE CHAIRMAN: Well, we will adjourn until Monday morning.

(Hearing adjourned until 9.30 A.M., September 24th, 1951)

.....

THE
OFFICE OF THE
ATTORNEY GENERAL
STATE OF NEW YORK
ALBANY, N. Y.
JANUARY 1, 1911

IN RE THE ESTATE OF
JAMES H. HARRIS

1. The Court, by its order of the 14th day of December, 1910, directed the executor of the will of James H. Harris to file a statement of the assets and liabilities of the estate, and to file a statement of the income of the estate for the year ending December 31, 1910.

2. The executor has filed a statement of the assets and liabilities of the estate, and a statement of the income of the estate for the year ending December 31, 1910.

3. The Court has examined the statement of the executor, and finds that the same is correct and true.

4. The Court has also examined the statement of the income of the estate, and finds that the same is correct and true.

5. The Court, therefore, directs the executor to pay to the beneficiaries of the will the amount of the income of the estate for the year ending December 31, 1910.

6. The Court also directs the executor to pay to the beneficiaries of the will the amount of the principal of the estate, as directed by the will.

IN WITNESS WHEREOF, I have hereunto set my hand and the seal of the Office of the Attorney General, at Albany, New York, this 1st day of January, 1911.

The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

Application for Permission to Remove or cause to be removed
Natural Gas from the Province of Alberta, under the Provisions of the
Gas Resources Preservation Act by Prairie Pipe Lines Limited.

I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session:

Volume_____

